Manual

Signal Generator

R&S® SMC100A

1411.4002K02

Test Equipment Depot
1-800-517-8431

99 Washington Street
Melrose, MA 02176
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Dear Customer,

throughout this manual, the Signal Generator R&S® SMC100A is abbreviated as R&S SMC.

The firmware of the instrument makes use of the operating system LINUX® and other valuable open source software packages. The most important of them are listed below together with their corresponding open source license. The verbatim license texts are provided on the user documentation CD-ROM (included in delivery).

Package	Link	License
LINUX® Kernel	http://www.linux.org/	GPL 2
gLibc	http://www.gnu.org/software/libc/	LGPL
busybox	http://www.busybox.net/	GPL 2
OpenSSL	http://www.openssl.org/	OpenSSL / SSLeay
XFree86	http://www.xfree86.org/	XFree86
Xitami	http://www.xitami.com	NetSnmp-5.0.8
PHP	http://www.php.net	2.5b6
OpenSSL	http://www.openssl.org	BSD
BOOST Library	http://www.boost.org	Artistic
zlib	http://www.zlib.net	Boost Software, v.1
PC/SC-Lite	http://www.linuxnet.com/	ACE_TAO

The OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/). includes cryptographic software written by Eric Young (eay@cryptsoft.com) and software written by Tim Hudson (tjh@cryptsoft.com).

LINUX® is a trademark of Linus Torvalds.

Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG.
Trade names are trademarks of the owners.

Tabbed Divider Overview

CD-ROM including complete operating manual and compiled online help (provided in the file inside pocket)

Data Sheet

Safety Instructions
Customer Information Regarding Produict Disposal
Certificate of Quality
EC Certificate of Conformity
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List of R&S Representatives

User documentation for the Signal Generator R&S SMC100A

Operating Manual

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4	Chapter 4:	Instrument Functions
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6	Chapter 6:	Remote Control - Description of Commands
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8	Chapter 8:	Maintenance and Interfaces
9	Chapter 9:	Error Messages
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Grouped Safety Messages

Make sure to read through and observe the following safety instructions!

All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standard of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment required for them are designed and tested in accordance with the relevant safety standards. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, the Rohde & Schwarz group of companies will be happy to answer them.

Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for an intention other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and a basic knowledge of English. It is therefore essential that only skilled and specialized staff or thoroughly trained personnel with the required skills be allowed to use the product. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation. Keep the basic safety instructions and the product documentation in a safe place and pass them on to the subsequent users.

Symbols and safety labels

Observe product documentation	Weight indication for units >18 kg	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal	Attention! Electrostatic sensitive devices

Supply voltage ON/OFF	Standby indication	Direct current (DC)	Alternating current (AC)	Direct/alternating current (DC/AC)	Device fully protected by double/reinforced insulation

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before putting the product into operation. It is also absolutely essential to observe the additional safety instructions on personal safety that appear in relevant parts of the product documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by the Rohde & Schwarz group of companies, including instruments, systems and all accessories.

Tags and their meaning

DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	NOTICE indicates a property damage message. In the product documentation, the word ATTENTION is used synonymously.

These tags are in accordance with the standard definition for civil applications in the European Economic Area. Definitions that deviate from the standard definition may also exist in other economic areas or military applications. It is therefore essential to make sure that the tags described here are always used only in connection with the related product documentation and the related product. The use of tags in connection with unrelated products or documentation can result in misinterpretation and thus contribute to personal injury or material damage.

Basic safety instructions

1. The product may be operated only under the operating conditions and in the positions specified by the manufacturer. Its ventilation must not be obstructed during operation. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products:
   prescribed operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only in enclosed spaces, max. operation altitude 2000 m above sea level, max. transport altitude 4500 m above sea level.
   A tolerance of ±10% shall apply to the nominal voltage and of ±5% to the nominal frequency.
2. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed. The product may be opened only by authorized, specially trained personnel. Prior to performing any work on the product or opening the product, the product must be disconnected from the supply network. Any adjustments, replacements of parts, maintenance or repair must be carried out only by technical personnel authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test).
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens, e.g. nickel) such as aluminum cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties), consult a physician immediately to determine the cause.
4. If products/components are mechanically and/or thermically processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled, e.g. for disposal purposes, by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.

5. If handling the product yields hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation.
6. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn life requires increased protection, pregnant women should be protected by appropriate measures. Persons with pacemakers may also be endangered by electromagnetic radiation. The employer/operator is required to assess workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the danger.
7. Operating the products requires special training and intense concentration. Make certain that persons who use the products are physically, mentally and emotionally fit enough to handle operating the products; otherwise injuries or material damage may occur. It is the responsibility of the employer to select suitable personnel for operating the products.
8. Prior to switching on the product, it must be ensured that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
9. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with earthing contact and protective earth connection.
10. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
11. If the product has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases, it must be ensured that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply. If products without power switches are integrated in racks or systems, a disconnecting device must be provided at the system level.
12. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by e.g. tripping over the cable or suffering an electric shock.
13. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
14. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, this can result in sparks, fire and/or injuries.
15. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
16. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
17. Ensure that the connections with information technology equipment comply with IEC 950/EN 60950.
18. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
19. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a license electrician.

20. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that suitable protection is provided for users and products.
21. Do not insert any objects into the openings in the housing that are not designed for this purpose. Never pour any liquids onto or into the housing. This can cause short circuits inside the product and/or electric shocks, fire or injuries.
22. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a thunderstorm) can reach the product. Otherwise the operating personnel will be endangered by electric shocks.
23. Rohde & Schwarz products are not protected against penetration of liquids, unless otherwise specified (see also safety instruction 1.). If this is not taken into account, there exists the danger of electric shock for the user or damage to the product, which can also lead to personal injury.
24. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product was moved from a cold to a warm environment.
25. Do not close any slots or openings on the product, since they are necessary for ventilation and prevent the product from overheating. Do not place the product on soft surfaces such as sofas or rugs or inside a closed housing, unless this is well ventilated.
26. Do not place the product on heat-generating devices such as radiators or fan heaters. The temperature of the environment must not exceed the maximum temperature specified in the data sheet.
27. Batteries and storage batteries must not be exposed to high temperatures or fire. Keep batteries and storage batteries away from children. Do not short-circuit batteries and storage batteries.
    If batteries or storage batteries are improperly replaced, this can cause an explosion (warning: lithium cells). Replace the battery or storage battery only with the matching Rohde & Schwarz type (see spare parts list). Batteries and storage batteries must be recycled and kept separate from residual waste. Batteries and storage batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.
28. Please be aware that in the event of a fire, toxic substances (gases, liquids etc.) that may be hazardous to your health may escape from the product.
29. The product can be very heavy. Be careful when moving it to avoid back or other physical injuries.
30. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves).
31. Handles on the products are designed exclusively for personnel to hold or carry the product. It is therefore not permissible to use handles for fastening the product to or on means of transport such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport and for observing the safety regulations of the manufacturer of the means of transport. Noncompliance can result in personal injury or material damage.
32. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. The driver is always responsible for the safety of the vehicle. The manufacturer assumes no responsibility for accidents or collisions.
33. If a laser product (e.g. a CD/DVD drive) is integrated in a Rohde & Schwarz product, do not use any other settings or functions than those described in the product documentation. Otherwise this may be hazardous to your health, since the laser beam can cause irreversible damage to your eyes. Never try to take such products apart, and never look into the laser beam.
34. Prior to cleaning, disconnect the product from the AC supply. Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluent for cellulose lacquers.

ROHDE&SCHWARZ

Customer Information Regarding Product Disposal

The German Electrical and Electronic Equipment (ElektroG) Act is an implementation of the following EC directives:

- 2002/96/EC on waste electrical and electronic equipment (WEEE) and
- 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).

Product labeling in accordance with EN 50419

Once the lifetime of a product has ended, this product must not be disposed of in the standard domestic refuse. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.

Rohde & Schwarz GmbH & Co. KG has developed a disposal concept for the environmental-friendly disposal or recycling of waste material and fully assumes its obligation as a producer to take back and dispose of electrical and electronic waste in accordance with the ElektroG Act.

Please contact your local service representative to dispose of the product.

Certified Quality System

DIN EN ISO 9001 : 2000
DIN EN 9100 : 2003
DIN EN ISO 14001 : 2004

DQS REG. NO 001954 QM UM

QUALITÄTSZERTIFIKAT

Sehr geehrter Kunde,
Sie haben sich für den Kauf eines Rohde&Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Managementsystems entwickelt, gefertigt und geprüft.
Das Rohde&Schwarz Managementsystem ist zertifiziert nach:

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:2004

CERTIFICATE OF QUALITY

Dear Customer,
you have decided to buy a Rohde&Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards.
The Rohde&Schwarz quality management system is certified according to:

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:2004

CERTIFICAT DE QUALITÉ

Cher Client,
vous avez choisi d'acheter un produit Rohde&Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité.
Le système de gestion qualité de Rohde&Schwarz a été homologué conformément aux normes:

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:2004

ROHDE&SCHWARZ

1171.0200.11-02.00

ROHDE&SCHWARZ

EC Certificate of Conformity

CE

Certificate No.: 2008-64

This is to certify that:

Equipment type	Stock No.	Designation
SMC100A	1411.4002.02	Signal Generator
SMC-B1	1411.6705.02	Reference Oscillator

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electrical equipment for use within defined voltage limits (2006/95/EC)
- relating to electromagnetic compatibility (2004/108/EC)

Conformity is proven by compliance with the following standards:

EN 61010-1 : 2001
EN 61326 : 1997 + A1 : 1998 + A2 : 2001 + A3 : 2003
EN 55011 : 1998 + A1 : 1999 + A2 : 2002, Class B
EN 61000-3-2 : 2000 + A2 : 2005
EN 61000-3-3 : 1995 + A1 : 2001

For the assessment of electromagnetic compatibility, the limits of radio interference for Class B equipment as well as the immunity to interference for operation in industry have been used as a basis.

Affixing the EC conformity mark as from 2008

ROHDE & SCHWARZ GmbH & Co. KG
Mühldorfstr. 15, D-81671 München

Munich, 2008-07-31

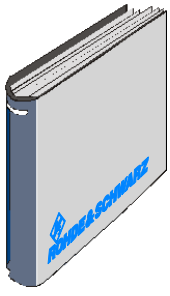
Central Quality Management MF-QZ / Radde

Contents of User Documentation for the Signal Generator R&S SMC100A

The user documentation describes the Signal Generator R&S SMC and all options. It includes a printed Quick Start Guide and a CD-ROM with the complete operating and service manual in printable pdf-format and the data sheet.

The R&S SMC is equipped with a context-sensitive online help that offers a help page for each instrument function.

Quick Start Guide

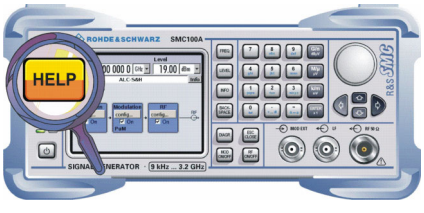


The present quick start guide describes everything that is needed to put the instrument into operation and to get familiar with the generator. The quick start guide gives an introduction to remote control and manual control via external monitor, mouse and keyboard.

The quick start guide is subdivided into 4 chapters plus index:

Chapter 1	describes the control elements and connectors on the front and rear panel as well as all procedures required for putting the instrument into operation.
Chapter 2	gives an introduction the operating concept and typical applications of the R&S SMC.
Chapter 3	describes key operating modes, the structure of the graphical interface and the principles of manual control.
Annex	contains an index for the quick start guide.

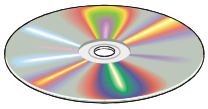
Help System



The help system is embedded in the instrument, offering quick, context-sensitive reference to the information needed for operation and programming. The help contains the complete user documentation for the Signal Generator including the contents of the present quick start guide.

The help files (*.chm) are also available on the CD-ROM and can be used as a standalone help.

Documentation CD-ROM

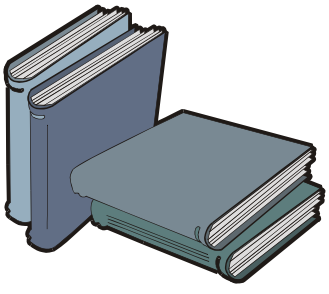


The CD-ROM provides the complete user documentation for the Signal Generator:

- The online help system (*.chm).
- The complete operating manual and service manual in printable form (*.pdf).
- The **data sheet** (brochure and data sheet) in printable form.
- Links to different useful sites in the R&S internet.

Note: *Please use the ADOBE® Acrobat® Reader for PDF files and the browser Internet Explorer® ≥ 4.0 for the HTML help.*

Optional Documentation



The printed version of the operating and service manual provides the contents of the quick start manual plus the complete reference and the service information for the Signal Generator. This manual can be ordered as an option (stock no. 1411.4060.32 (English - A4 format) or 1411.4060.39 (English - letter format)); see ordering information in the data sheet.

Note: *The CD-ROM contains the *.pdf version of the manuals.*

Manual Control

The operating manual contains comprehensive information about the instrument functions and remote control, in addition to the chapters of the quick start guide. It includes information about maintenance of the instrument and about error detection listing the error messages which may be output by the instrument. It is subdivided into 10 chapters:

The data sheet	informs about specifications and characteristics of the instrument.
Chapter 1	describes the control elements and connectors on the front and rear panel as well as all procedures required for putting the instrument into operation.
Chapter 2	gives an introduction to the operating concept and typical applications of the R&S SMC.
Chapter 3	describes key operating modes, the structure of the graphical interface and the principles of manual control.

Chapter 4 forms a reference for manual control of the R&S SMC and contains a detailed description of all instrument functions and their application. The chapter also lists the remote control command corresponding to each instrument function.

Remote Control

Chapter 5 describes the basics for programming the R&S SMC, command processing and the status reporting system.

Chapter 6 lists all the remote-control commands defined for the instrument.

Chapter 7 -

Chapter 8 describes preventive maintenance and the characteristics of the instrument's interfaces.

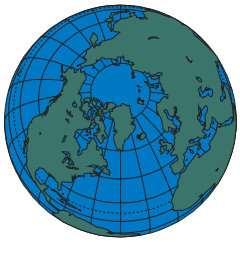
Chapter 9 gives the status messages and a list of error messages that the R&S SMC may generate.

Annex lists the remote-control commands in alphabetical order, and
contains an index of the operating manual.

Service Manual Instrument

The service manual - instrument informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for the maintenance of R&S SMC by exchanging modules. In addition it describes how to perform a firmware update and how to install options.

Internet Site



The Internet site at: Signal Generator R&S SMC100A provides the most up to date information on the R&S SMC. Additionally firmware updates including the associated release notes, instrument drivers, current data sheets and application notes are provided for download on the internet site.

The current operating manual at a time is available as printable PDF file in the download area.

Contents - Chapter 1 "Putting into Operation"

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1 Putting into Operation

Introduction - Putting into Operation

Chapter 1, "Putting into Operation" explains the control elements and connectors of the R&S SMC Signal Generator with the aid of the front and rear views and describes how to put the instrument into operation. It also describes the connection of peripherals such as keyboard and mouse. A detailed description of the device interfaces is given in chapter 8, "*Maintenance and Remote Control Interfaces*". The specifications of interfaces are described in the data sheet.

Chapter 2, "*Getting Started*" gives an overview of generator functions and introduces the operating concept. Detailed operating instructions and an overview of menus follow in chapter 3, "*Manual Operation*".

The complete manual is provided on the CD-ROM in printable pdf-format: Menus and instrument functions are described in detail in chapter 4, "*Instrument Functions*", basics of remote control of the instrument in chapter 5, "*Remote Control - Basics*" and commands for remote control in chapter 6, "*Remote Control - Commands*". Chapter 9, "*Error Messages*" contains a list of possible status and error messages.

Legend for Front Panel View

This section gives an overview of control elements and connectors on the front panel of the R&S SMC. Each element/connector is briefly described and a reference is given to the chapters containing detailed information.

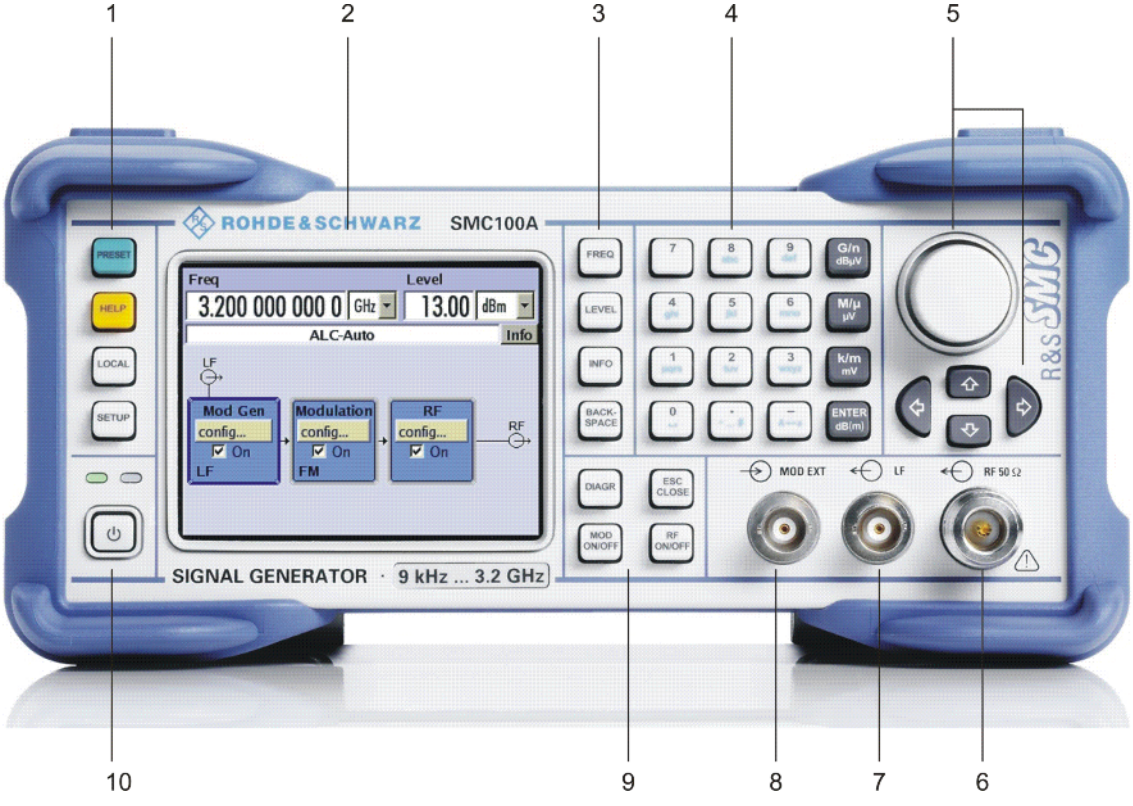


Figure 1-1 Front panel view

1 Keys for general instrument settings

PRESET
Sets the instrument to a defined state.

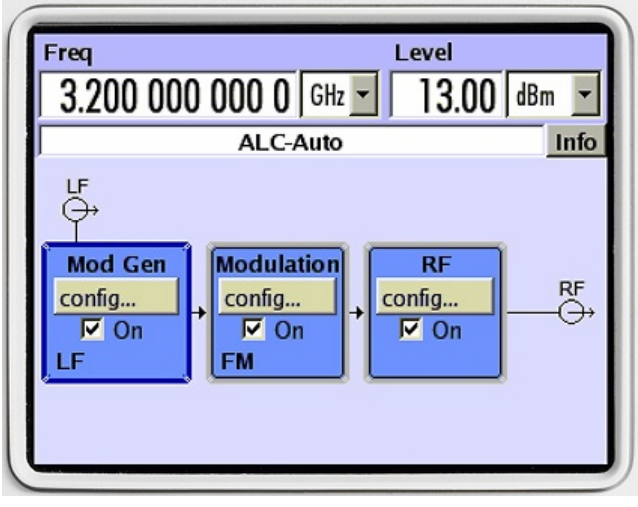
HELP
Displays context-sensitive help text.

LOCAL
Switches from REMOTE control to LOCAL (manual) control.

SETUP
Opens the setup menu for configuring general instrument settings.

See chapter 4, section "*General Instrument Settings*"

2 Display



Display
The display clearly shows all main settings and signal generator states.

The display is divided into two sections:
- Frequency and level display with info line (status bar)
- Block diagram

Display
The **block diagram** shows the current configuration and the signal flow in the generator with the aid of function blocks containing an ON/OFFswitch. Clicking the function block opens a list of associated setting menus. Active menus and info windows are displayed on top of the block diagram. The block diagram is displayed in the foreground by pressing the diagram button Diagram or by clicking on the **DIAGR** key in the key emulation dialog.

See chapter 3, section "*Display*"

3 Keys for setting frequency and level

FREQ
Activates frequency entry.

LEVEL
Activates level entry.

INFO
Displays status messages, error messages and warnings.

BACKSPACE
Deletes the character to the left of the cursor.

See chapter 3, section *"Setting Parameters"*, and chapter 4, section "*RF Signal"* and "*Modulations"*

4 Keypad for data entry

Keypad for data entry

0…9
Entry of numeric values

.
Entry of decimal point

–
Entry of sign

abc
Entry of letters

␣
Entry of a space

*… #
Entry of special characters

A ↔ a
Switchover between uppercase and lowercase letters.

See chapter 3, section *"Setting Parameters"*

4 Keypad for data entry

Keys for data entry

The unit keys can either select a unit and thus determine the absolute value, or change the unit. Their function depends on the time at which they are pressed during parameter entry:

Selecting the unit

If a unit key is pressed immediately after a numeric value has been entered, it terminates the entry and determines the multiplication factor for the respective basic unit (e.g. the k/m key determines the unit kHz after frequency entry).

If a level value is entered, the unit indicated on the unit key is used (e.g. the k/m mV key determines the unit mV for level entry). The level entry must be activated, e.g. by pressing the LEVEL key.

See chapter 3, section "*Selecting a Unit - Setting Parameters*"

Changing the unit

If a numeric entry is terminated with the rotary knob and not with a unit key, the unit displayed in the unit field of the parameter in the menu is assigned. If the unit key is pressed later, the unit is changed but not the value. The value is recalculated to suit the new unit (e.g. the display changes from 1000 to 1 when the Hz is changed to kHz). The new unit is then indicated in the value field of the menu.

See chapter 3, section "*Selecting a Unit - Setting Parameters*"

Assignment

G/n	dBµV	giga/nano, dBµV for RF levels, dBu for LF levels
M/µ	µV	mega/micro, µV for levels
k/m	mV	kilo/milli, mV for levels
ENTER		dB(m) basic unit dBm for levels dB for level offset and level step width
		function as ENTER key for unit-free values

4 Keypad for data entry

ENTER

- Calls the next menu level.
- Activates the editing mode for highlighted numeric and alphanumeric parameters.
- Terminates a data entry; the new value is set.In case of numeric parameters, the unit indicated next to the value in the menu applies.
- Switches highlighted status parameters on and OFF (ON/OFFstate).
- Confirms (OK) and closes message windows.

See chapter 3, section *"Setting Parameters"*

5 Keys for settings and navigation in the display and for setting parameters

Keys for settings and navigation in the display and for setting parameters

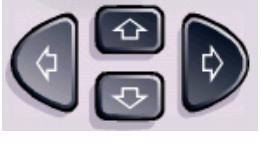
See chapter 3, section *"Setting Parameters*

Rotary knob

- Varies the value at a cursor position. For frequency and level entry, a fixed step width can be set and activated for the variation.
- Moves the entry cursor in the block diagram or menu.
- Moves the cursor in tables and selection lists.
- Clicking the rotary knob (= Enter) terminates entries. In this case the entry mode is terminated and the value set.

Keys for setting and navigation in the display and for setting parameters

See chapter 3, section *"Setting Parameters*



Arrow keys

Vary the entry value or highlight a selected list item in the editing mode.
Highlight parameters in menus and tables (up/down).

Move the cursor in the entry fields (editing mode). Highlight parameters in menus and tables (left/right).

6 RF output

RF

Output for RF signal.

See data sheet and chapter 4, section "*RF Signal*"

NOTICE **Maximum Input Levels**

Do not overload the RF output. The maximum permissible back-feed is specified in the data sheet.

7 LF output

LF

Output for internal modulation generator signal.

8 Input for external AM / FM / PhiM signals

MOD EXT

Input for external modulation signals.

9 Keypad for data entry

DIAGR

Brings the block diagram to the foreground. Active menus are minimized.

ESC
CLOSE

Calls the next higher selection level. This opens up the following functions:

- Closes the active menu if the cursor is in the top-level menu (parameter selection).
- Switches between different entry fields of a menu.
- Quits the editing mode and restores the previous value. This function is only available in the editing mode, i.e. only before an entry is confirmed or selected with Enter.
- Cancels queries in message windows.
- Shifts the entry cursor from the frequency or level display to the previously active menu, or to the previously highlighted block in the block diagram if no menu is active.

MOD ON/OFF Switches the active modulations on and off.

RF ON/OFF

Switches the RF signal on and off.

See chapter 3, section *"Setting Parameters"*, and chapter 4, section "*RF Signal"* and "*Modulations"*

10 Standby ON/OFFswitch

The on/off switch switches the instrument from the standby mode to the operating state provided the power switch on the rear of the instrument is switched on.

The yellow LED (right) is on in the standby mode; the green LED (left) is on when the instrument is ready for operation.

See chapter 1, section "*Switching On*"

CAUTION

Danger of shock hazard!

The instrument is still power-supplied while it is in standby mode.

Legend for Rear Panel View

This section gives an overview of connectors on the rear panel of the R&S SMC. Each connector is briefly described and a reference is given to the chapters containing detailed information. For technical data of the connectors refer to the data sheet.

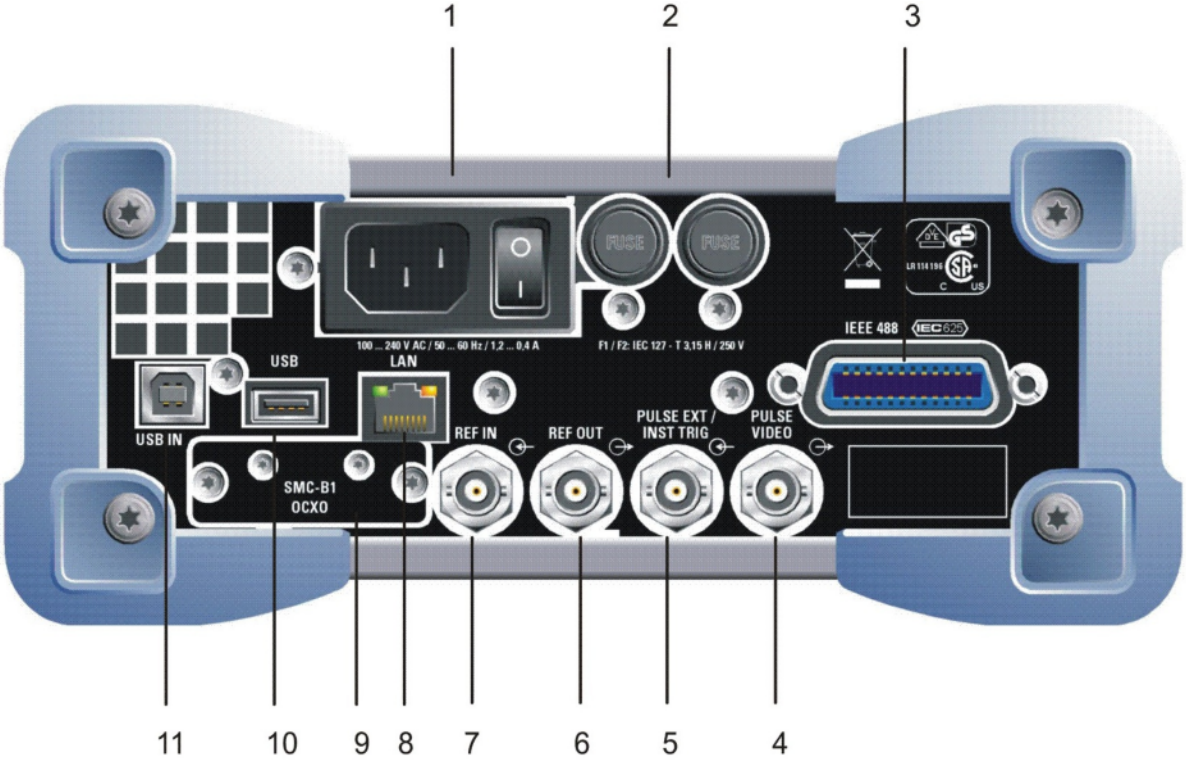


Fig. 1-2 Rear panel view

1 AC supply

AC supply connector.

When the R&S SMC is connected to the AC supply, it automatically sets itself to the correct range for the applied voltage (range: see type label). There is no need to set the voltage manually or change fuses.

Power switch.

The main power switch switches the power of the instrument on.

See chapter 1, section "*Connecting the R&S SMC to the AC Supply*" and data sheet

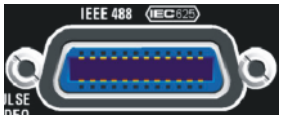
2 Fuses

Fuses:

The R&S SMC is fully fused by two fuses IEC127-T3.15H/250 V.

See chapter 1, section "*Power Fuses*" and data sheet

3 IEEE 488 - IEC/IEEE-bus connector



IEC 625/IEEE 488

IEC-bus (IEEE 488) interface for remote control of the R&S SMC.

See data sheet and chapter 8, section "*IEC/IEEE Bus Interface*"

4 Output of pulse and video signal

PULSE VIDEO

Output of internal pulse generator signal or external pulse signal fed in via the PULSE EXT connector (video signal).

See chapter 4, section "*Pulse Modulation*"

5 Input of external pulse signal / Instrument triggering

PULSE EXT

Input of external pulse signal or input of external trigger/gate signal for internal pulse generator.

INST TRIG

Input for external trigger for sweeps.

See chapter 4, section "*Pulse Modulation*", data sheet and chapter 4, section "*Sweep Mode*"

6 Reference signal output

REF OUT

Output of internal 10-MHz-reference signal.

See data sheet and chapter 4, section "*RF Reference Frequency - Reference Oscillator*"

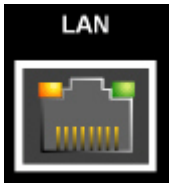
7 Reference signal input

REF IN

Input for external 10-MHz-reference signal.

See data sheet and chapter 4, section "*RF Reference Frequency - Reference Oscillator*"

8 LAN interface



LAN

Ethernet interface
- Remote control of signal generator
- Remote access to graphical user interface of signal generator.

See data sheet and chapter 1, section "*Connecting the R&S SMC to a Network (LAN)*", chapter 8, section "*LAN Connector*" and chapter 5, section "*Remote Control via LAN Interface*""

9 Oven-controlled reference oscillator (option R&S SMC-B1)

OCXO

This option (option R&S SMC-B1) generates a very precise 10 MHz reference signal. It needs some minutes of warm-up time to reach its nominal frequency.

See data sheet

10 USB connectors type A

USB

USB (universal serial bus) interfaces of type A (host).
- Connection of peripherals such as mouse and keyboard
- Connection of memory stick for firmware update

See chapter 1, section "*Connecting an External Keyboard and Mouse*" and chapter 8, section "*USB Connection (USB and USB IN)*"

11 USB interface type B

USB IN

USB (universal serial bus) interface of type B (device) for remote control of signal generator.

See chapter 8, section "*USB Connection (USB and USB IN)*"

Putting into Operation

The following section describes the procedure for putting the instrument into operation. It contains general safety instructions for instrument operation.

The installation of options and the firmware update are described in chapter 4 of the Service Manual (supplied with the instrument on the CD-ROM).

Unpacking the Instrument

- Remove the instrument from its packaging and check the equipment for completeness using the delivery note and the accessory lists for the various items.
- First, pull off the polyethylene protection pads from the instrument's rear feet and then carefully remove the pads from the instrument handles on the front.
- Pull off the corrugated cardboard cover that protects the rear of the instrument.
- Carefully unthread the corrugated cardboard cover on the front that protects the instrument handles and remove it.
- Check the instrument for any damage. If there is damage, immediately contact the carrier who delivered the instrument. In this case, make sure not to discard the box and packing material.

It is advisable to keep the original packing material in order to prevent control elements and connectors from being damaged in case the instrument is to be transported or shipped at a later date.

Setting up the Instrument or Installing it in a 19" Rack

The instrument is designed for indoors use. It can either be set up independently or mounted in a 19" rack.

A rack adapter (refer to data sheet for Order No.) is required for installation in a 19" rack. The mounting instructions are supplied with the adapter.

NOTICE	**Risk of overheating!**
	Insufficient airflow for cooling may cause overheating of the instrument.
	Prior to putting the instrument into operation always check for space between the ventilation holes and the rack casing to get sufficient air supply in the rack.

Safety Instructions

General Precautions

NOTICE **Instrument damage caused by disregarding the following precautions!**

Any non-compliance with the following precautions may cause damage to the instrument. Prior to putting the instrument into operation, check the following:

- The covers of the housing are in place and screwed on.
- Vents are not obstructed. Make sure that the air can escape freely through the vents at the sides. The minimum distance to the wall should therefore be at least 10 cm.
- The signal levels at the inputs do not exceed permissible limits.
- The outputs of the instrument are not overloaded or incorrectly connected. This particularly applies to the maximum permissible back-feed at the outputs, which is specified in the data sheet.
- The ambient temperature must not exceed the range specified in the data sheet.

Please also observe the instructions in the following sections and the general safety instructions at the beginning of this manual.

Protection against Electrostatics

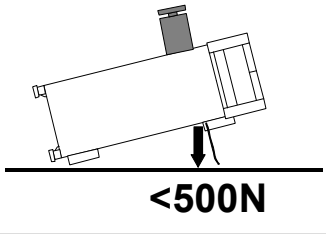
To avoid damaging the electronic components of the EUT (Equipment Under Test) due to electrostatic discharge produced by contact, the use of appropriate protective measures is recommended.

Setting up the Instrument

CAUTION **Risk of injury and instrument damage.**

Safe operation with support feet!

- Stacked **instruments** may slip off.
  Secure stacked instruments against slipping (e.g. by locking the feet to the top of the front-panel frame). The feet must be fully folded in or folded out. Only then a stable position of the instrument and reliable operation can be ensured. The uniform pressure on the folded-out feet must not exceed 500 N (weight of instrument and of equipment stacked on top).
- When using the instrument with expanded feet, the feet might collapse and fold in. **Do not shift the instrument with the feet out**.



Cleaning the Outside and Storing

What is necessary is essentially the cleaning of the instrument.

NOTICE **Instrument damage caused by cleaning agents!**
Prior to cleaning, disconnect the product from the AC supply.
Cleaning agents contain substances that may damage the instrument, e.g. solvent-containing cleaning agents may damage the front panel labeling or plastic parts.
Never use cleaning agents such as solvents (e.g. diluent for lacquers, thinners, acetone, alcohol, etc), or acids, bases, or other substances.

Use a soft, non-linting cloth to suitably clean the outside of the instrument.

EMC Safety Precautions

To avoid EMI (Electro Magnetic Interference) double shielded signal and control cables must be used at all signal connectors.

Outputs and lines have to be terminated properly with 50 Ohms. USB devices must keep within permissible EMI limits.

Connecting the R&S SMC to the AC Supply

The R&S SMC is automatically matched to the applied AC voltage (see rear panel). There is no need to set the voltage manually or change fuses. The AC supply connector is on the rear of the unit (see below).

Switching On

1. Connect the signal generator to the AC supply by means of the supplied power cable.

   Since the instrument is a protection class I equipment, it should only be connected to a socket with a protective earth contact.
2. Press the main power switch on the rear of the instrument to position **I**.
3. After power-up the instrument is either ready for operation (STANDBY) or in operating mode, depending on the state of the ON/STANDBY switch on the instrument front (see below).

Note: *The power switch may remain on for any period of time. Switching off is required only if the instrument should be completely isolated from the AC supply.*

4. Press the ON/STANDBY switch on the front panel; the green LED must be on.
5. After booting the software, the instrument is ready for operation. All modules in the instrument are supplied with power.

Start Display and Booting the R&S SMC

After instrument switch-on, the Linux operating system boots first and then the instrument firmware.

After booting is completed, the block diagram of the signal generator is displayed. The green lighting LED on the front panel indicates that the instrument is ready to be operated. The settings that were active before the last switch-off are established unless another start setting has explicitly been selected in the **File** menu.

Note:
If the software stops unexpectedly, the instrument can be shut down by pressing the STANDBY key for approx. 5 s.

Switching Off

1. Press the ON/STANDBY switch on the front panel.

The R&S SMC stores the current setting before it shuts down the Linux operating system. Then the AC supply is switched to the STANDBY mode.

2. Only the AC supply is powered.
3. The yellow LED must be on.

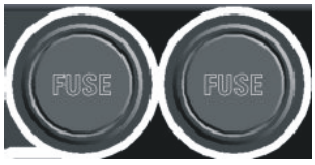
CAUTION **Danger of shock hazard!**

The instrument is still power-supplied while it is in standby mode.

1. Press the main power switch on the rear of the instrument to position **0**. None of the front-panel LEDs should be on.

Note:
It is recommended to switch the instrument to STANDBY mode before completely disconnecting it from the AC supply. If the power switch is set to 0 before the instrument is switched to the standby mode, all current settings are lost.

Power Fuses



The R&S SMC is fully fused by two fuses IEC127-T3.15H/250 V. The fuses are accommodated in the fuse holders next to the power connector. Use only fuses of the mentioned type.

CAUTION **Shock hazard!**

For fuse replacement, ensure that the instrument is switched off and disconnected from the power supply.

Prior to fuse replacement, disconnect the power cord from the R&S SMC.

Function Check

The signal generator automatically monitors the main functions when the instrument is switched on and continuously during operation.

If a fault is detected, ERROR is displayed in the info line together with a brief error description.

For in-depth identification of the error, press the INFO key. In response, a description of the error(s) is displayed (see chapter 9, "*Error Messages*").

Besides automatic monitoring of instrument functions, other capabilities in the R&S SMC ensure correct functioning of the signal generator.

- **Internal Adjustments**
  Adjustments can be performed in the **Setup-System-Internal Adjustments** menu. Thus, optimum modulation performance can be obtained, for instance.
- **Self Test**
  Internal test points are queried by the instruments´ firmware and checked for correct values. See chapter 4, section "*Selftest".*

Default Settings

The instrument is set to a defined state with the PRESET key. With PRESET, all parameters and switch states are preset, including those of deactivated operating modes. The default instrument settings provide a reproducible initial basis for all other settings.However, functions that concern the integration of the instrument into a measurement setup are not changed, e.g. IEC/IEEE bus address or reference oscillator source settings.

Note:
Resetting the instrument to the factory state is possible in the Factory Preset - Setup Settings menu of the menu.

When the instrument is switched on, it is not the preset state that is active, but rather the instrument state that was set before the instrument was switched off. An exeption is the state of the RF output. The state of the RF output power-on state can be set to be always off in the **EMF** menu of the RF block.

User-defined instrument states can be stored and called up in the **File** menu.

The following table gives an overview of the presets for the most important generator settings. The other presets can be found in the information accompanying the IEC/IEEE-bus commands (chapter "*Remote Control Commands - Description*").

The list below the table shows the settings that are not affected by the PRESET key.

RF frequency	1 GHz
RF level	OFF
Offsets	0
Modulations	switched off
Uninterrupted level setting	switched off; level attenuator mode: AUTO
Internal level control	Level ALC: AUTO
User correction	Level Ucor: OFF
LF output	switched off
Sweep	switched off

Settings that are not affected by the PRESET key

- Reference frequency settings (Ref Oscillator menu)
- Power on settings (Level/EMF menu)
- Network settings (Setup menu)
- IEC/IEEE-bus address (Setup menu)
- *IDN? identification (Setup menu)
- Password and settings protected by passwords (Setup menu)
- Start/Stop Gui Update (Setup menu)
- Display and keyboard settings (Setup menu).

Linux Operating System

NOTICE **Possible impairment of the functioning of the instrument**

The instrument is equipped with the Linux operating system. It is thus possible to install COTS software in the instrument. The use and installation of commercial off-the-shelf (COTS) software may impair the instrument function. For this reason, we recommend that you only execute programs tested by Rohde&Schwarz with regard to their compatibility with the instrument software.

The drivers and programs used in the instrument under Linux have been adapted to the test instrument. Existing instrument software **must only** be modified with update software released by Rohde & Schwarz.

The signal generator is equipped with the Linux operating system (please note the statement at the back of the title page). The configuration of the operating system is optimally adapted to signal generator functions in the factory. Changes in the system setup are only required when peripherals like keyboard are installed or in the event that the network configuration does not comply with the default settings (see sections "*Connecting the R&S SMC to a Network (LAN)*").

After power-up of the signal generator, the operating system boots and the instrument firmware is started automatically. The operating system cannot be accessed. All necessary system settings can be made in the **Setup** menu.

The R&S SMC provides an internal flash memory, it does not contain a disk drive. The flash memory holds the operating system, the firmware and the stored data. Data transfer is possible via a memory stick connected to a USB interface. The memory stick and the flash memory are accessed via the **File Manager**.

Screen saver:

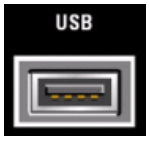
A screen saver can be activated in the R&S SMC. When active the display is shut off when no entries via front panel, external mouse or external keyboard are made for a period of time. The screen saver prolongs the life time of the display.

The screen saver can be switched off and on and the time period can be set in the **Environment** section of the **Setup** menu.

Connecting an External Keyboard and Mouse

A commercial, external keyboard and mouse with USB interface can be connected to the R&S SMC. A keyboard simplifies the entry of list items, comments, file names, etc.. A mouse simplifies the control of the block diagram and of associated menus.

The keyboard and the mouse are connected to the USB interface, type A, on the rear panel of the instrument.



The keyboard and mouse are recognized automatically when they are connected. The US keyboard assignment is the default setting. The keyboard assignment and special settings such as the refresh rate can be changed in the **Environment** section of the **Setup** menu.

Connecting the R&S SMC to a Network (LAN)

The R&S SMC is equipped with a network interface and can be connected to an Ethernet LAN (local area network).

Provided the appropriate rights have been assigned by the network administrator, the instrument can be remote-controlled and remote-accessed in the network.

Remote-access means that the user can operate the R&S SMC from any remote PC in the network using the **VNC** protocoll. For instance, the user can control one or more R&S SMCs from a desk that is part of a test assembly located in another section of the building.

A VNC client programm for Windows operating systems is provided on the R&S SMC CD-ROM (included in delivery). VNC client programms for other operating systems are available free-of-charge on the internet.

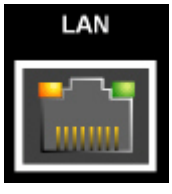
Remote-control of the instrument via the LAN interface is described in chapter 5, section "*Remote Control via LAN Interface*".

The configuration of the R&S SMC for networking is performed in the **Environment** section of the **Setup** menu.

Connection to the Network

NOTICE	**Risk of network errors!** Connecting errors may affect the entire network. We recommend to coordinate the connection of the instrument to the network with the network administrator.

The instrument is connected to the LAN with the aid of a commercial RJ-45 cable suitable for a 10/100Mbps connection attached to the LAN interface on the rear of the instrument.



The connector is described in chapter 8, "Maintenance and Interfaces".

Configuring the R&S SMC for Network Operation

The network interface functions with 10/100Mbps Ethernet IEEE 802.3u. The TCP/IP network protocol and the associated network services are preconfigured.

For data exchange in a LAN, each connected PC or instrument must be accessible via an IP address or via an unambiguous computer name. In the **Environment-Network Settings** section of the **Setup** menu, three modes of assigning the IP address or computer name can be selected. The correct mode selection depends on the setup of the network.

Networks using DHCP

The R&S SMC is preconfigured for networks using DHCP (dynamic host configuration protocol). In these networks, an available IP address is automatically assigned to the R&S SMC. The R&S SMC provides an unambiguous computer name in the network via the DHCP request. The DHCP server in the network must consider this name and pass it to the DNS server in order to ensure that the R&S SMC can be addressed in the network.

Each R&S SMC is assigned an individual computer name in the factory. This name can be queried and changed in **Environment-Network Settings** section of the **Setup** menu. The mode setting is **Auto (DHCP)**.

Networks using fixed IP addresses

In networks using fixed IP addresses, the addresses are mostly assigned by the network administrator. A fixed IP address must be entered in the **Environment-Network Settings** section of the **Setup** menu (see "*Identifying the R&S SMC in the Network*" below). The mode setting is **Static**.

Point-to-Point Connection

To build a simple network – just a LAN connection between the R&S SMC and a controller without integration into a larger network – an IP address has to be assigned to the R&S SMC and the controller. For such purposes, the IP addresses 192.168.xxx.yyy are available .The value range for xxx and yyy is 1...254, the value for the subnet mask is always 255.255.255.0. The gateway IP address must also be provided, however, it is without relevance. The mode setting is **Peer To Peer**.

Example:

On the PC:

1. Open the TCP/IP settings tab (network connection in the control panel)
2. Set fixed IP address (= deactivate DHCP)
3. Select IP address 192.168.0.1
4. Select subnet mask 255.255.255.0

On the signal generator:

1. Open the network setting panel in the Setup menu
2. Select IP address 192.168.0.2
3. Select subnet mask 255.255.255.0
4. Activate the setting

For this type of connection, a commercial cross-over RJ-45 cable is used.

Identifying the R&S SMC in the Network

1. Open the **Setup** menu by pressing the Setup key
2. Click **Network Settings** menu in the **Environment** section .
3. Select the IP address mode and enter the network data in the respective fields of the menu. The data is provided by the network administrator. The Computer name is indicated in the **Hostname** field. The name can be changed.

Remote Access via an External Controller

The R&S SMC can be remote-accessed from an external PC via a network link. This allows convenient operation of the signal generator from the desktop although the instrument is integrated in a rack somewhere else.

Remote access in contrast to **remote control** does not use remote-control commands but the regular user interface displayed using separate software which is installed on the external PC. The instrument can thus be manually operated from the PC as on the unit itself.

Preconditions for remote access are a connection between signal generator and PC via a LAN network and the installation of the VNC client software on the PC and on the R&S SMC.

The VNC client software for setting up the connection is included in the Linux/Unix operating system per default.

For Windows operating system, the free-of-charge software **Ultr@VNC** is provided on the R&S SMC CD-ROM. VNC client programms for other operating systems are available free-of-charge on the internet.
After the connection is established, the signal generator screen with the block diagram is displayed on the external PC and the R&S SMC can be manually remote-accessed from the external PC. The individual functions are operated using the mouse and keyboard. Specific instrument functions can be executed using specific key combinations on the keyboard or a front panel key emulation that can be operated with the mouse (see chapter 3, section "*Legend of Front-Panel Controls*").

Installation of the software Ultr@VNC and establishing the connection between external PC and signal generator for Windows operating system is described in the following. Remote access via an external controller with Linux/Unix operating system is performed accordingly.

Configuration for Remote Access via Ultr@VNC

The instrument is operated with the aid of the program **Ultr@VNC**. It is available as a free-of-charge download on the internet for operating system Window XP (*http://www.uvnc.com/download/index.html*) and on the R&S SMC CD-ROM.

Remote access of the signal generator is possible under the following conditions:

- The external PC with Linux/Unix or Windows operating system (Windows 95 or higher) is equipped with a LAN interface which is configured for the network.
- The signal generator and PC are linked via a LAN.
- A user-specific password for the **VNC** connection is defined on the R&S SMC. The default password is "instrument", it can be changed in the **Environment-Security** section of the **Setup** menu.
- The **Ultr@VNC Viewer** software is installed on the external PC (or any other VNC client) R&S SMC IP address and the user-specific password for the **VNC** connection are entered in the **VNC Viewer** panel.

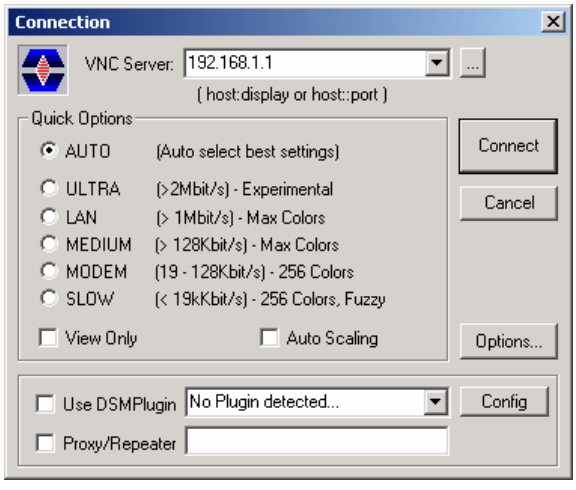
NOTICE **Risk of unauthorized access!**
After enabling the VNC connection, any user on the network who knows the password and IP address of the signal generator can access this R&S SMC. Even after cutting it, the connection is still enabled and the R&S SMC can be accessed any time. To disable the connection, the **VNC program on the R&S SMC must be uninstalled or the VNC server service disabled**.
To enhance security, also **communication on the network via Ultr@VNC** program **should be disabled** in the firewall.

Install VNC Viewer and Establish VNC Connection on the Windows PC

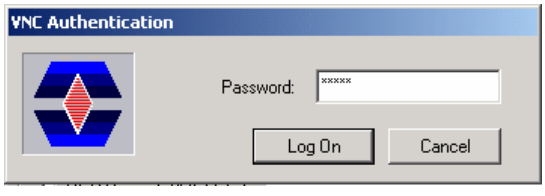
The **Ultr@VNC** program is available on the Internet as a free-of-charge download or on the R&S SMC CD-ROM. Following the instructions on the Internet, the program can be copied onto the external Windows PC. Only the program component **VNC Viewer** is required.

Note:
*The **VNC Viewer** program is included in the download for the installation of the Ultr@VNC program on the signal generator if **Full installation** was selected in the **Select Component** panel. In this case, the program ultr@vncviewer.exe can be copied to the Windows PC.*

1. Install **VNC Viewer** program component on the PC.
2. Start **VNC Viewer** program component on the PC.



3. Enter IP address (or host name) of R&S SMC in input line **VNC Server.**
4. Initialize the connection by pressing the **Connect** button.
   A message requesting the password appears.



5. Enter the **VNC** password defined in the **Environment-Security** section of the **Setup** menu of R&S SMC (default = "instrument"). The connection is established when the **Log On** button is pressed.

After the connection is established, the current signal generator screen with the block diagram is displayed and the R&S SMC can be manually remote-controlled from the external PC. The individual functions are operated using the mouse and keyboard. Specific instrument functions can be executed using specific key combinations on the keyboard (see table in chapter 3, section "*Legend of Front-Panel Controls*"). Direct control on the R&S SMC is possible while manual remote-control is established, it can be performed alternately with the remote access.

Close Remote Access Connection via Ultr@VNC

The connection can be closed on the external PC by closing the VNC Viewer program.

Closing the connection does not disable it. It can be established again any time.

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2 Getting Started

Introduction - Getting Started

The Signal Generator R&S SMC is suitable for applications which require sine wave signals with high spectral purity, i.e. signals with high quality. The internal LF generator is used as a modulation source and permits generation of analog modulated signals. A signal can be amplitude (AM), frequency (FM), phase (PhiM) or pulse (PM) modulated. With its adjustable frequency range from 9 kHz up to 3.2 GHz the generator is especially designed for medium scale RF generation. Various fields of applications are covered, e.g. in lab, service, production and quality assurance.

The main applications are:

- generating modulated signals to check the data taken by a receiver
- functionality testing of components in production
- generation of modulated signals which are required in mobile radio
- signal generation and modulation for EMC measurements of components
- test equipment for service and maintenance
- applications in research and apprenticeship, e.g at universities

The instrument´s main features are:

- high signal quality
- internal analog modulation modes: AM, FM, PhiM
- pulse modulation
- frequency and level sweep
- remote control via USB, LAN and IEC Bus

The instrument is operated either by using it´s own graphical user interface (GUI) in stand alone mode, or remote controlled via an USB or a LAN interface. Optionally, for faster operation by remote control the instrument can be equipped with an IEC bus interface (option R&S SMC-K4).

The architecture of the R&S SMC and the signal flow are shown in a block diagram on the R&S SMC user interface. In the diagram, signal processing is performed from left to right (left: modulation generator, right: RF output). The block diagram in the figure below shows the R&S SMC.

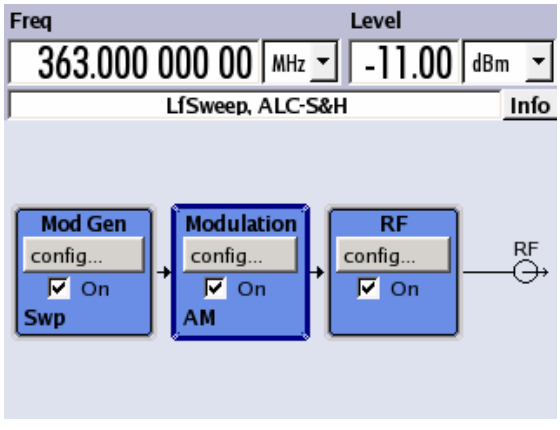


Fig. 2-1 Block diagram of R&S SMC

For signal generation the instrument is equipped with one of the frequency options:

R&S SMC-B101 9 kHz to 1.1 GHz

R&S SMC-B103 9 kHz to 3.2 GHz

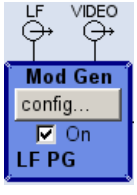
For more detailed information on options, refer to the R&S SMC data sheet (available on the R&S SMC homepage on the internet; *http://www.rohde-schwarz.com/product/SMC100A*).

Description of Individual Diagram Blocks

Available Blocks

Block	Function of block	Status display in the block	Effect of the On checkboxes, or the MOD ON/OFF and RF ON/OFF keys
Mod Gen	The internal modulation signals are configured and activated. LF-sweep is configured and activated. The internal pulse generator is configured and activated.	Status of modulation generator. Active sweep. Active pulse generator.	Switches the selected internal LF generator and the pulse generator on or off.
Modulation	The modulations are configured and activated.	Active modulations.	MOD ON/OFF Switches the active modulation on or off. The modulations are activated in the respective dialog boxes.
RF	RF signal is configured and activated.	State of RF output. Activated sweeps.	RF ON/OFF Switches the RF output on or off.

Mod Gen block



The internal modulation sources are configured in this block. The **LF frequency sweep** can be activated here and an internal **LF generator** is available as the internal source for the analog modulations AM, FM and PHiM. The used modulation shape is a sine wave signal.

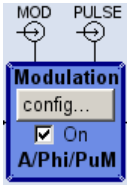
The internal modulation generator signal is provided at the **LF** output on the front of the instrument. The LF output signal and the modulations sources for the analog modulations AM, FM and PhiM can be selected independently from each other.

A **pulse generator** provides single and double pulse modulation with selectable pulse widths and periods. The internal pulse generator signal is provided at the **PULSE VIDEO** output connector on the rear panel of the instrument.

The R&S SMC Signal Generator offers three different sweep types (RF frequency sweep, level sweep and LF frequency sweep) to be activated alternatively. Each type has 6 modes which differ with respect to the sweep cycle mode (continuous, individual and step-by-step) and triggering mode (automatic, internal and external). In the **Mod Gen** block, the LF sweep is configured. Frequency and level sweep settings are accessed via the RF block.

The status line in the block displays whether the LF generator, the pulse generator and/or a sweep are active.

Modulation block



The internal and external analog modulations are configured and activated in the **Modulation** block. The MOD ON/OFF key switches the active modulation(s) on/off.

The internal modulation sources are configured in the Mod Gen block. External amplitude, frequency or phase modulation signals can be fed in at the input connector **MOD EXT** on the front of the instrument. An external pulse signal is fed in via the BNC connector **PULSE EXT** on the rear of the instrument. AC or DC coupling for external feed is possible.

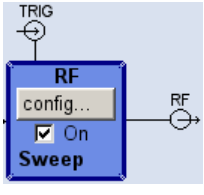
Available internal and external analog modulation modes are:

- Amplitude modulation (AM)
- Frequency modulation (FM)
- Phase modulation (PhiM)
- Pulse modulation (PULSE)

Note:
An activated frequency modulation disables phase modulation and vice versa. For modulation modes that can be simultaneously used, refer to the R&S SMC data sheet.

The status line in the block displays the active modulation(s).

RF block



The RF parameters and frequency/level sweep settings are set in the **RF** block.

An active sweep is displayed in the statusline of the block. The RF ON/OFF key switches the RF signal on and off. When the RF signal is switched off, the switch before the RF output symbol is open.

The **RF 50 Ω** output connector on the front of the instrument provides the output of the RF signal. An external trigger/gate signal for sweeps is input via the **INSTR TRIG** connector on the rear of the instrument.

RF settings include:

- Frequency and reference frequency
- Level settings; if required.
- Frequency and level sweep.

Hint:
*Set the frequency or level values directly in the **entry fields of the status bar** either*
- by pressing the FREQ or LEVEL buttons on the front panel of the instrument or
- by clicking on the Frequency or Level keys in the key emulation dialog.
Alternatively the values are set in the dialogs RF / Frequency / Phase or RF Level / EMF.

Info and Help System

The R&S SMC comprises a comprehensive **info** and **help system**. Context-sensitive help can be called any time with the HELP key. The help system indicates the currently selected parameter and offers additional services such as cross references, index and contents. The content of the help system corresponds to the operating manual of the R&S SMC.

Warning and conflict messages caused by incorrect operation as well as further information are displayed in the **Info line**. A complete list of existing conflicts is displayed when the INFO key is pressed. Additional information on entries can be requested from the help system. The history function permits display of all messages.

Detailed operating instructions and an overview of menus follow in chapter 3, "*Manual Operation*".

Menus and instrument functions are described in detail in chapter 4, "*Instrument Functions*".

Example of Setup

A central element of the R&S SMC display is the block diagram that illustrates the signal flow. Each block represents a section of signal generation. The main settings of a block are indicated in the block. The interconnection of active inputs and outputs is also shown. The user is thus always informed about the connection of inputs and outputs in the signal flow and where they can be configured.

A window is opened for each menu where parameters can be set. All open menus are of equal priority (not modal) and can be accessed any time.

The R&S SMC can be entirely operated from the front panel. Peripherals such as mouse or keyboard can be connected but are not essential.

With the aid of the rotary knob, the user can navigate in the block diagram and the dialogs. The cursor is moved line by line through the block diagram or dialog. Turning the button clockwise advances the cursor.

The selected block can be activated or deactivated with the On checkboxes or with the MOD ON/OFF or RF ON/OFF key, respectively. Active blocks are highlighted by a colored background.

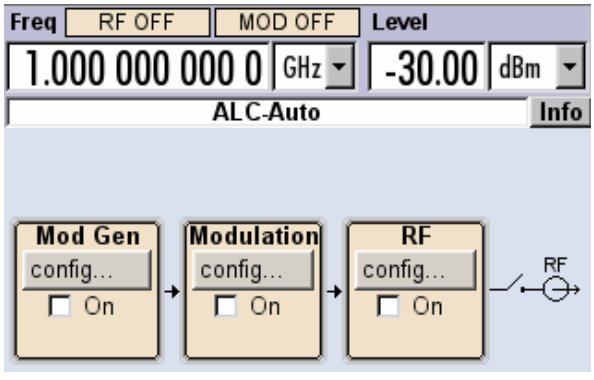
Generation of an Amplitude-Modulated Signal

In the example, a simple AM-modulated signal is configured. Proceed as described below:

1. Activate default (preset) state.
2. Select and activate AM modulation.
3. Set frequency and level and activate RF signal.

Step 1: Activate default (preset) state

Set a defined instrument state by pressing the PRESET key.

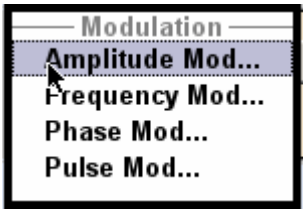


Step 2: Select and activate AM modulation

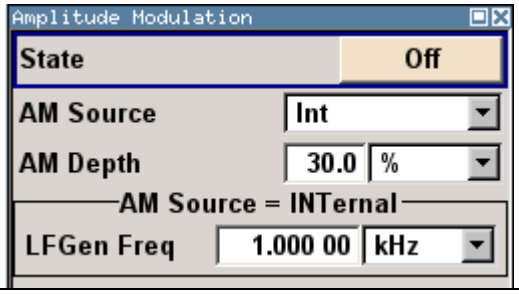
Select the **Modulation** block by turning the rotary knob.

Press the rotary knob to open the menu where the modulation can be selected.

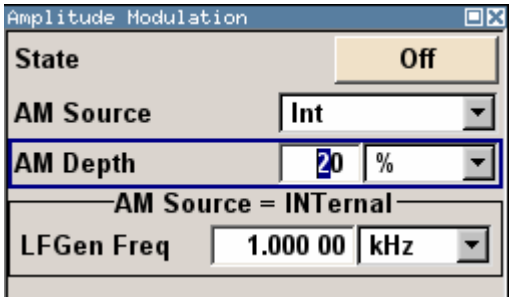
The **Amplitude Mod...** menu is the first menu item and is highlighted per default.



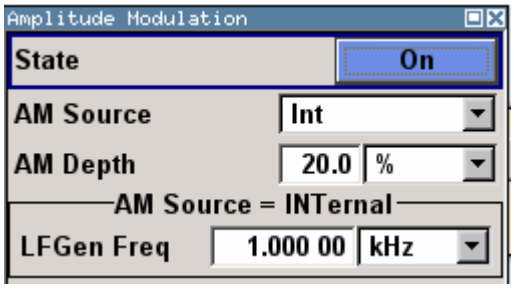
Press the rotary knob to open the **Amplitude Modulation** menu.



Select the **AM Depth** parameter by turning the rotary knob, and then enter the desired AM depth with the aid of the numeric keypad and the unit keys.



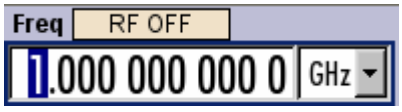
Finally, switch on AM modulation by selecting **State On** and subsequently pressing the rotary knob.



To indicate the active state, the **Modulation** block is displayed in blue. The **RF** block is not yet active, therefore no RF signal is output.

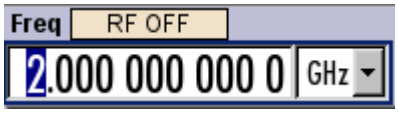
Step 3: Set frequency and level and activate the RF signal

Press the FREQ key to activate the editing mode for frequency entry. The frequency entry field in the header section of the display is highlighted.



Enter the frequency value of the desired RF carrier using the numeric keypad, e.g. 2 GHz.

Terminate the entry by pressing the appropriate unit key.

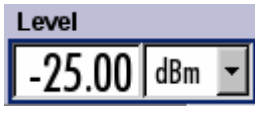


Enter the level of the desired RF carrier in the same way:

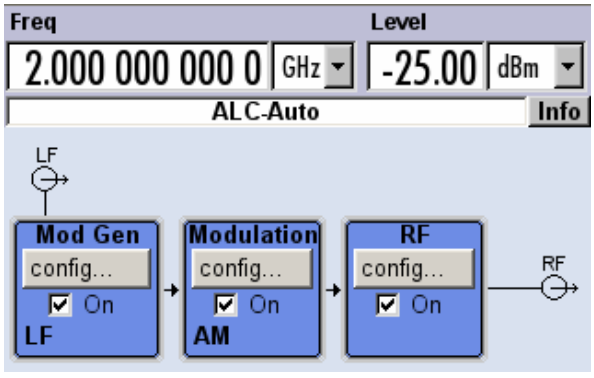
Press the LEVEL key to activate the editing mode for level entry. The level entry field in the header section of the display is highlighted.

Enter the level value of the desired RF carrier using the numeric keypad, e.g. -25 dBm.

Terminate the entry by pressing the appropriate unit key.



Select the **RF** block by turning the rotary knob and activate it by pressing the RF ON/OFF key.



The AM modulation signal is now present at the RF output.

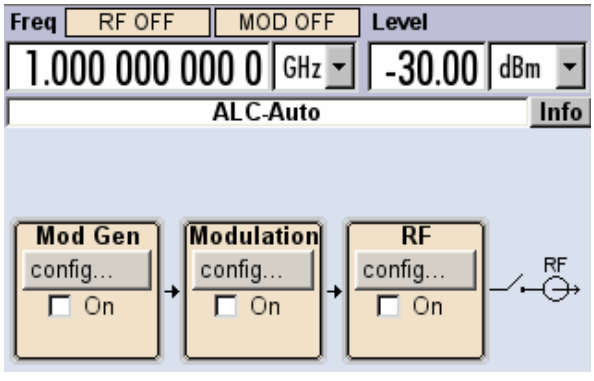
Generation of an RF Frequency Sweep Signal

In the example, an RF frequency sweep is configured. Proceed as described below:

1. Activate default (preset) state.
2. Configure and activate RF frequency sweep.
   The settings are:
   - start frequency: 100 MHz
   - stop frequency: 500 MHz.
   - linear spacing with a step width of 1 MHz
   - dwell time 10 ms
   - single sweep mode
3. Activate RF signal.
4. Trigger single sweep

Step 1: Activate default (preset) state

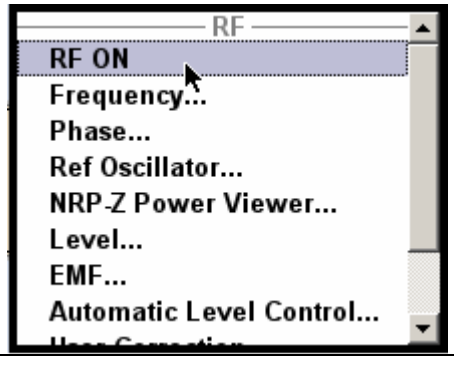
Set a defined instrument state by pressing the PRESET key.



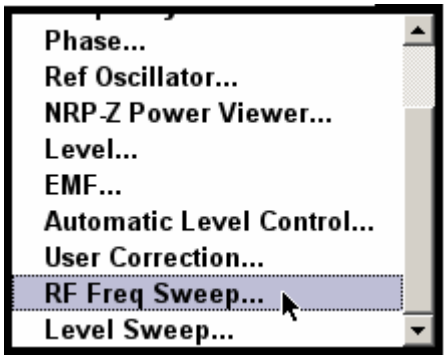
Step 2: Configure and activate RF frequency sweep

Select the **RF** block by turning the rotary knob.

Press the rotary knob to open the menu where the RF frequency sweep menu item can be selected.

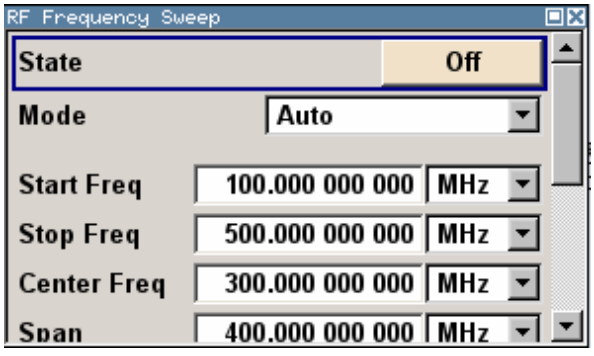


Select **RF Freq Sweep...** by turning the rotary knob.



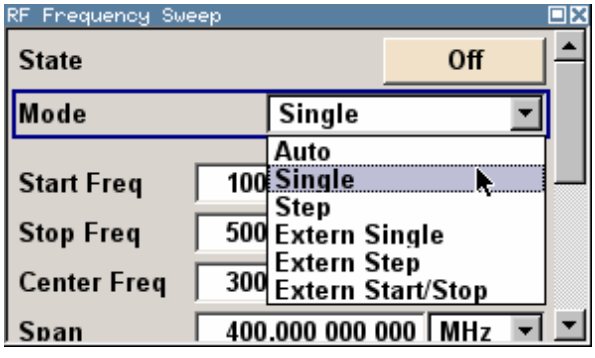
Press the rotary knob to open the **RF Freq Sweep** menu.

All sweep parameters are default except for the sweep mode. The default settings are not changed.



Select the **Mode** parameter by turning the rotary knob. Press the rotary knob and select setting **Single** from the list by turning the rotary knob.

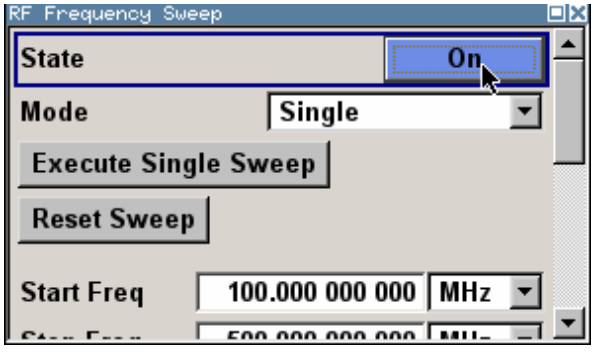
Press the rotary knob, now the sweep mode is set to single sweep from start to stop frequency.



Switch on RF frequency sweep by selecting **State On**.

Now the **Execute Single Sweep** button to trigger the single sweep appears.

The **RF** is not yet active, which means that no RF signal is output.



Step 3: Activate RF signal

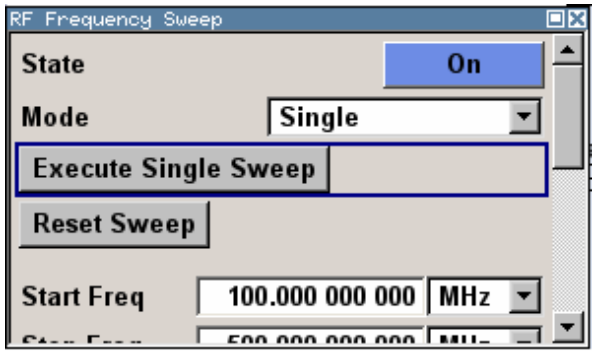
Activate the RF signal output by pressing the RF ON/OFF key.

To indicate the active state, the **RF** block is displayed in blue. An RF signal with the default frequency and level settings is output, i.e. 1 GHz and -30 dBm.

The single sweep still must be triggered in the sweep menu.

Step 4: Trigger single RF frequency sweep

Select the **Execute Single Sweep** button in the RF frequency sweep menu by turning the rotary knob. Press the rotary knob.



A linear single sweep from 100 MHz to 500 MHz in 1 MHz steps is output with a dwell time of 10 ms per step.

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3 Manual Operation

Introduction - Manual Operation

The R&S SMC Signal Generator can be operated intuitively either via the interactive block diagram or via a menu tree. All menus are in the form of windows that can be operated in the same way. Rotary knob, keys and softkeys, or alternatively a mouse, allow direct and therefore convenient access to entries and settings. The clear-cut display shows the current signal generator state. Numerous help functions support the user in signal configuration.

The following chapter describes manual operation of the signal generator. This includes a description of screenshots, operation of menus and the block diagram and the setting of parameters.

Chapter 4 "*Instrument Functions*" includes a detailed description of signal generator functions. Chapter 2 "*Getting Started*" explains the operating concept in general and includes a brief introduction to operation by a step-by-step description of the configuration. Remote control of the instrument is described in chapters 5, "*Remote Control - Basics*" and in chapter 6, "*Remote Control - Commands*".

Operating Concept

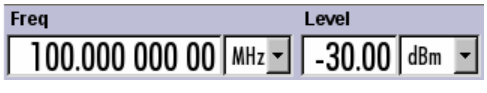
The operating concept of the R&S SMC enables the user to make settings as intuitively as possible and at the same time gives a permanent overview of characteristics of the generated signal and of the current instrument state. Numerous on-line help functions support user settings.

The block diagram is the core of the operating concept.

The graphics display showing the current configuration and the signal flow in the form of a block diagram is the core of the operating concept of the R&S SMC Signal Generator. The block diagram gives an overview of signal configuration, and the graphical elements can be accessed for operation. The desired element is selected by means of the rotary knob and the associated setting function is called by clicking this button. Required menus are displayed on the block diagram which is displayed again in the foreground whenever the DIAGR key is pressed.

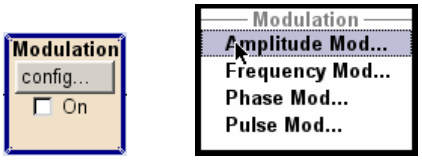
Permanent display of frequency and level of the RF output signal

The main characteristics of the RF signal, frequency and level, are permanently displayed in the header section of the screen and can be directly set in the display fields after the FREQ or LEVEL key is pressed. Status messages for the output signal are displayed in addition to frequency and level.

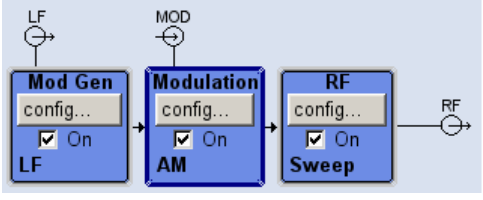


Operation via the graphics interface

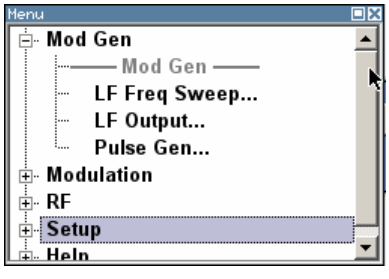
Menus are assigned to the specific function blocks in the block diagram. The function blocks represent elements of signal generation, e.g. the **Modulation** block which contains all menus required for modulation signal configuration. In this block all modulations can be selected. Function blocks displayed with a blue frame can be directly switched on and off by means of the MOD ON/OFF key. In the example, amplitude modulation can be activated in this way. The menus of the highlighted function blocks can be called by clicking the rotary knob or by pressing the ENTER key.



The signal flow between the function blocks and the employed inputs and outputs are also shown.

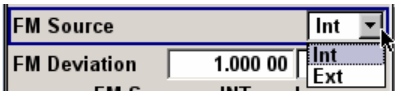


The menu tree can be opened and closed with the SETUP key. The menu tree is organized in the same way as the directories under Windows. The function blocks correspond to the first directory level, the menus to subdirectories.

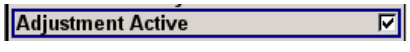


Operation corresponds to the Windows concept

To offer the user a familiar environment, operation is very similar to operation of Windows user interfaces. All menus and tables are made up of known elements, e.g. selection lists,



check boxes,



or entry fields.

A blue frame indicates that the selected item is active. In the highlighted element, entries can be made.

Most of the settings can be easily made with the rotary knob

Operation is possible via front-panel keys, an external keyboard and the mouse. Most of the settings can be made with the rotary knob:

- Turning the rotary knob shifts the entry focus to the desired element.
- Clicking the rotary knob activates the selected entry field.
  Depending on the parameter, the submenu is now called, the numeric value varied, the list entry selected or the check box activated or deactivated.
- If a value is entered, the entry is stored by another click on the rotary knob and the editing mode is exited.

Clear settings with the aid of independent submenus

A separate menu is opened for each menu and submenu. The menus can be operated independently of each other, i.e. none of the menus requires that settings in other menus be completed before it can be closed. This ensures flexible operation at all times.

The Winbar gives an overview of menus and simplifies their access.

The menus are displayed on top of the block diagram but they can be "hidden" using the DIAGR key. They can be displayed again in full size (toggle functionality of the DIAGR key).

The keys are assigned simple functions

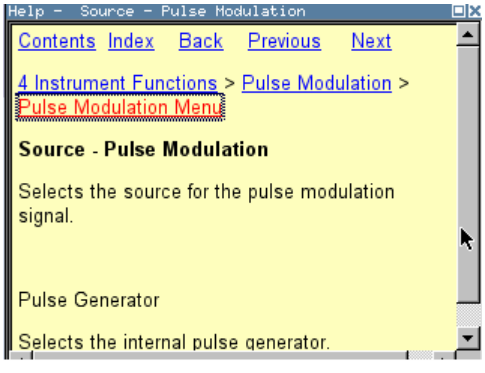
Most keys on the front panel of the R&S SMC directly perform a simple function. Since a great number of settings can thus be made by a keystroke, operation is easy. For instance, the CLOSE key closes the active menu; with the RF ON/OFF key the RF output signal can be switched on or off.

An exception are keys that call a menu such as the SETUP key which opens the menu for general instrument settings.

Help functions support the user

Numerous help functions support the user in signal configuration.

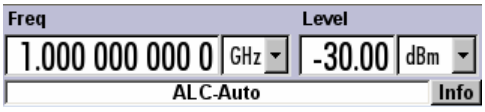
Context-sensitive help for each parameter can be called with the HELP key:


Help - Source - Pulse Modulation
Contents Index Back Previous Next
4 Instrument Functions > Pulse Modulation >
Pulse Modulation Menu
Source - Pulse Modulation
Selects the source for the pulse modulation signal.
Pulse Generator
Selects the internal pulse generator.

Each help page is part of a comprehensive online help function which can be called by means of the **Content**, **Index**, **Back**, **Previous** and **Next** links.

Messages indicate the current instrument state

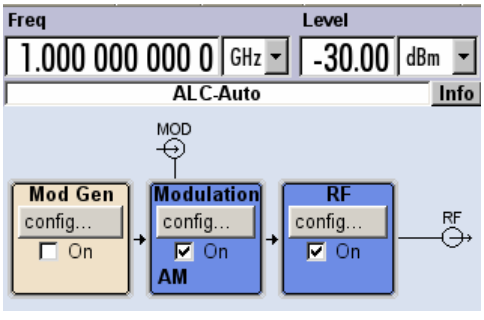
A great variety of different messages such as status messages, error messages, warnings or information are displayed in the header field of the screen. With the aid of the INFO key, help pages can be called for most of the messages. They provide background information on the message and indicate operating steps that may be required. All messages are explained in the online help which can be called with the HELP key.



Display

The display shows the current signal generator state and offers graphical elements for direct operation. It is divided into two sections:

- The frequency and level display with info line indicates the main output signal parameters and reports the current state with status, error and warning messages.
- The block diagram shows the instrument configuration, the signal characteristic as well as the inputs and outputs used and permits interactive operation via graphics elements. Active menus and info windows are displayed on top of the block diagram.



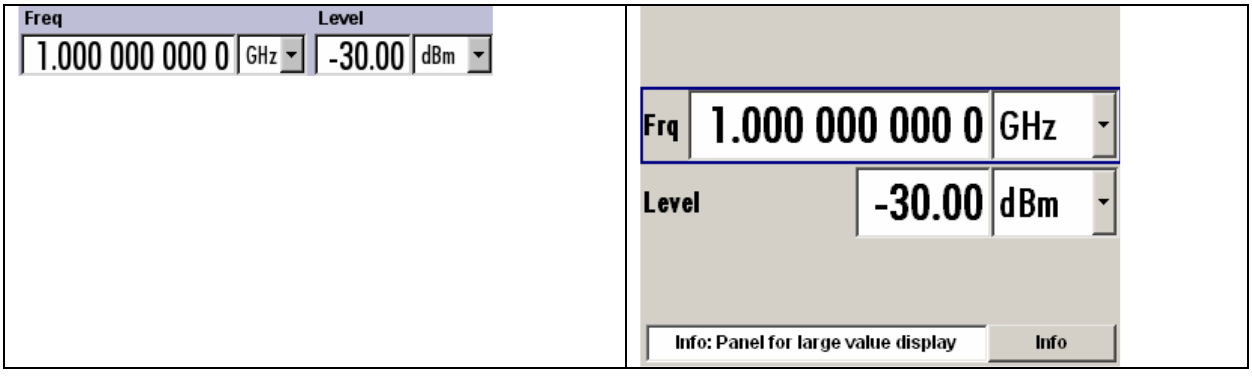
Frequency and Level Setting - Display

Frequency/level settings and a few status messages (see below) are displayed in the header field of the screen. The display may vary depending on the instrument's operating mode:

- In the sweep mode, the current frequency or level of the output signal is displayed.
- If user correction is active, the status message **UCorr** is displayed in the info line.

It should be noted that the signal at the RF output may differ from the indicated value by a set offset (frequency or level) (see sections "*RF Frequency*" and "*RF Level*" in chapter 4.)

The frequency and level indication can be enlarged so that it covers the complete display of the R&S SMC by using the DIAGR key. This key toggles between block diagram, magnified frequency and level indication and the display of the active menu.



Status Information and Messages - Display

The status information and messages are displayed in the header section of the screen. The messages differ with respect to their importance (errors, warnings, info) and the time of their appearance (brief and permanent messages). They require different treatment by the user. Further information on all messages can be called in the info window (see section "*Info Window - Display*", page 3.6).

Chapter 9, "*Error Messages*" includes an overview of all status information and messages as well as instructions for error elimination.

Status Information

The status information gives the user an overview of the main operating states and settings of the R&S SMC. The states are indicated for information only and do not necessitate any action by the user. Status information is displayed between the frequency and level fields, at the left of the info line or in the info line itself.

Messages

Messages indicate errors in the instrument. They are displayed in the info line in different colors depending on their importance and display duration. Errors (e.g. no calibration data) are displayed in red, information (e.g. file not found) and warnings in black. Warnings indicate less significant errors (e.g. the instrument operates outside specified data).

Volatile messages

Volatile messages report automatic settings in the instrument (e.g. switching off of incompatible types of modulation) or on illegal entries that are not accepted by the instrument (e.g. range violations). They are displayed in the info line on a yellow background. They are displayed on top of status information or permanent messages.

Volatile messages do not normally demand user actions and disappear automatically after a brief period of time. They are stored in the history, however.

Remote-control command:
`SYST:ERR?` or `SYST:ERR:ALL?`

Permanent messages

Permanent messages are displayed if an error occurs that impairs further instrument operation, e.g. a hardware fault. The error signalled by a permanent message must be eliminated before correct instrument operation can be ensured.

The message is displayed until the error is eliminated. It covers the status display in the info line. After error elimination, the message automatically disappears and is also recorded in the history.

Remote-control command:
`SYST:SERR?`

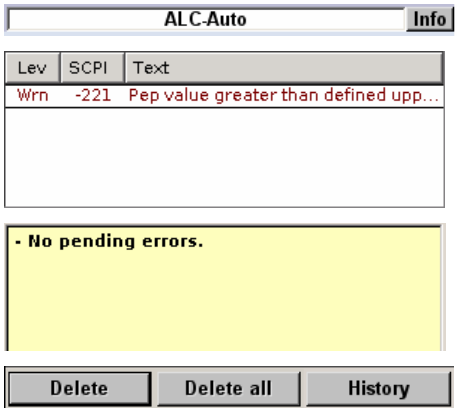
Info Window - Display

A few operating states and the current message are displayed in the info line (see also chapter 9, "*Error Messages*").

The info window with a list of current permanent messages and a detailed description of each message can be opened with the INFO key.

The upper section of the info window contains a list of all current permanent messages in the order of their occurrence, i.e. the most recent message is displayed first. In the lower section of the window, additional information on the highlighted message is displayed.

A history of all messages that have occurred since instrument switch-on can be called with the **History** button. The most recent message is displayed first.



Info line

List of current messages with short message text.

Detailed description for highlighted message

Buttons

The messages are color-coded according to their level. Device-specific messages are red, info and remote control error are black. The level is also indicated in the **Lev** column (Err, Sys or Info). Column **SCPI** indicates the SCPI error code.

With the aid of the softkey buttons, error messages can be cleared and a history of all messages called.

Delete Clears the highlighted message. This button is available only if the history of the message is displayed.

Remote-control command: n.a.

Delete All Clears all messages. This button is available only if the history of the message is displayed.

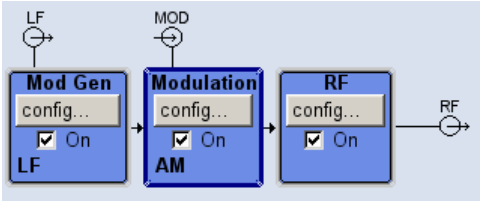
Remote-control command:
`SYST:ERR:ALL?`
(Each time a `SYSTem:ERRor:ALL?` query is sent, the error queue is returned and at the same time cleared).

History Calls the list of all messages that have occurred since instrument switch-on. The most recent messages are displayed at the top of the list. When the button is pressed again, the list of current messages is displayed.

Remote-control command:
`SYST:ERR? or STAT:QUE?`
(Each time a `SYSTem:ERRor?` or `:STATus:QUEue?` query is sent, the oldest entry in the error queue is returned and at the same time cleared in the list).

Block Diagram - Display

The block diagram shows provided options, signal configuration and the currently selected signal flow of the generator with inputs and outputs used. Signal generation can be completely operated from the block diagram. A highlighted function block can be directly switched on and off with the toggle keys MOD ON/OFF or RF ON/OFF. Clicking the rotary knob (= Enter) opens the associated settings menu.



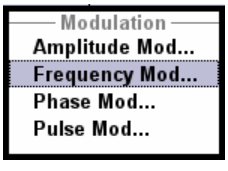
Function Blocks in the Block Diagram

Each block represents a function of signal generation. The function is indicated in the headline of the block, e.g. **Modulation**. In this block, the modulation signals are set, for instance.

In the check box On, the respective function can be quickly activated/ deactivated with the MOD ON/OFF key. After activation, the block is displayed in blue.

Status information is displayed below the check box. It is different for the different blocks. In the Mod block, for instance, the selected modulation is indicated.

Clicking the rotary knob (front panel) or the **config...** button (mouse) opens the associated setting menu.

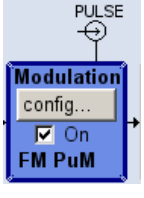


Signal Flow and Input/Output Symbols in the Block Diagram

The input/output symbols in the block diagram show the currently used inputs and outputs of the signal generator. Unused inputs and outputs are not shown. The lines indicate the signal flow.

Symbols and labels refer to the corresponding inputs and outputs on the front and rear panel of the signal generator. The direction - input or output - is indicated by an arrow.

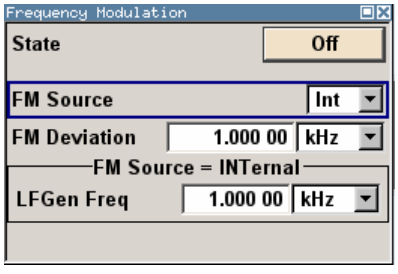
Example:



The symbols indicate the input for the external pulse signal on the instrument rear panel.

Menu Structure - Display

The parameters are set in the menus. Menus are called either via the function blocks in the diagram or by means of the setup menu key. The menus are displayed on top of the block diagram. If the menu buttons assign menu-specific functions to the softkeys, the Winbar is hidden.



This section describes the menu structure. Menu operation is described in section "*Menu Operation*", page 3.18, the setting of parameters in section *"Setting Parameters"*, page 3.11.

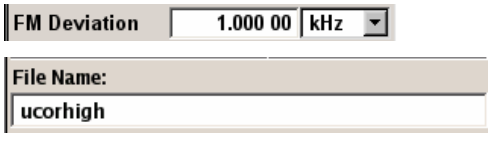
The menus are in Windows format. They differ in details depending on their function but they consist of the same main elements.

Menu header

The header line contains the name of the menu (e.g. Frequency / Phase) and the button for closing the menu. The button can be operated with the mouse. For operation from the front panel, the CLOSE key can be used.

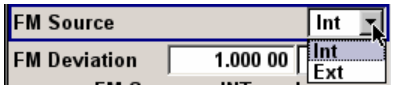
The remaining menu area is variable and comprises various fields for setting parameters.

Each of the setting fields is assigned a parameter name. The kind of setting varies depending on the parameter to be set.



Entry field

A numeric value (e.g. frequency offset) or an alpha-numeric value (e.g. file name) can be entered in this field.



Selection field

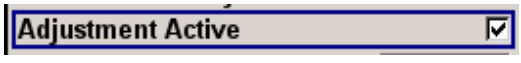
The button indicates that a selection can be made from a list. The fold-down selection list is displayed below the selection field. Depending on the number of entries, the full list or only part of it is shown.

One entry at a time can be selected from the list.

If an item is not available for selection, it is printed in grey and cannot be accessed.

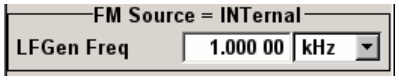
Units

The unit of a parameter is displayed next to the value. When the parameter is edited, the unit is selected either from the list or by means of the front-panel keys. When the entry is completed, the unit can be changed. In this case the value remains unchanged but is automatically adapted to the new unit.



Check-box field

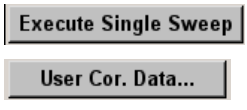
If the check box is ticked, the associated parameter setting is active (e.g. switched on).



Menu area

Several fields of associated but separately set parameters can be organized in a menu area.

The menu area is framed and labelled with the function common to all parameters (e.g. FM Source).



Buttons

The buttons either trigger a single action (e.g. **Execute Single Sweep**), or call the next menu level (to be identified by 3 dots, e.g. **User Correction Data...**).

Setting Parameters

The R&S SMC offers several and sometimes alternative possibilities for setting parameters. Operation is possible from the front panel, with the aid of a mouse and/or from a PC keyboard. Operation of the R&S SMC with the aid of these control media is shown in the tables below.

Frequency and level are directly set in the header area of the display using the FREQ and LEVEL keys.

Some of the keys trigger a direct action, e.g. the RF ON/OFF key switches the RF output on and off. An overview of key functions can be found at the end of this chapter (see section "*Legend of Front-Panel Controls*", page *3.26*), a detailed description of key functions is given in chapter 4, "Instrument Functions"

Most of the parameters are set in the menus. Menus can be opened from the function blocks of the diagram either with the aid of the rotary knob (= Enter) on the front-panel or by a mouse click on the **Config...** button.

An exception are the **Setup** and **File** menus. In the **Setup** menu, general settings are made which are not directly concerned with signal generation, e.g. setting of the IEC/IEEE-bus address. In the **File** menu, files and lists are managed. These menus can only be called with the SETUP keys.

Specific settings can also be made directly in the block diagram, e.g. activating a function block by means of the toggle keys MOD ON/OFF and RF ON/OFF. Changes affecting the signal flow are immediately visible in the graphics display.

Calling a Menu - Setting Parameters

After instrument switch-on, the cursor is always on the first function block of the diagram (default setting). It can be moved by means of the rotary knob or the arrow keys. Clicking the rotary knob opens the menu associated with the function block. The Menu button of the key emulation the opens the complete menu tree.

With the aid of the appropriate keys and softkeys, the cursor can also be moved to the header area or the Winbar.

- The FREQ and LEVEL keys activate the frequency or level entry fields in the header area.
- The DIAGR key The DIAGR key toggles between block diagram, magnified frequency and level indication and the display of the active menu.
- The Winbar button moves the Winbar to the forground. The button that was active last in the Winbar is highlighted. The associated menu is activated by clicking the rotary knob (= Enter).
- The SETUP key opens the complete menu tree. Menus are closed with the ESC/CLOSE key.
- The cursor can also be moved with the ESC/CLOSE key. However, the function of this key depends on the current cursor position:

  Parameter field (editing mode):
  The editing mode is terminated and the previous value is restored (exception: value variations with the rotary knob cannot be cancelled).

  Menu area:
  The cursor is set to another menu area.

  Menu:
  The menu is closed and the cursor changes to the next higher control level.

Frequency/level field:

The cursor is set on the previously active menu or, if no menu was active, on the first function block in the diagram.

Function block in the diagram:

The cursor is set on the first menu in the Winbar. If no menus are open, the current cursor position remains unchanged.

Function	Front panel	PC keyboard	Mouse
Edits the frequency or level in the entry fields of the header area	Press FREQ or LEVEL key. Enter value.	Press CTRL + F (frequency) or CTRL + L (level). Enter value.	Click the entry field and enter value.
Activates the block diagram	Press DIAGR key.	Press CTRL + D.	Click the function block.
Activates the Winbar	Press softkey.	Press CTRL + F1... F8 Press CTRL + W.	Click button in Winbar.
Calls the Setup or File menu or the menu tree	Press SETUP key.	Press CTRL + S (Setup) or CTRL + M (menu tree).	-

Selecting a Control Element - Setting Parameters

Control elements are always selected in the same way no matter whether a function block in the diagram, a menu in the menu tree, a parameter in the menu or an entry in a list or table is concerned.

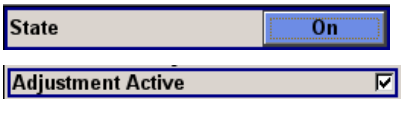
- An element is activated by means of the cursor. An active element is highlighted by a blue frame.

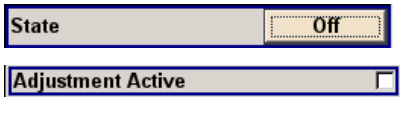
Function	Front panel	PC keyboard	Mouse
Selects an element	Select element by means of the rotary knob or the arrow keys.	Select element by means of the arrow keys.	Click element.

Switching Parameters ON/OFF - Setting Parameters

A parameter can be activated and deactivated using a button or a check box.

The ENTER function of the different control media switches the highlighted element on or off (toggle function). Colour and label of a button change, the check box is ticked or the tick is removed.

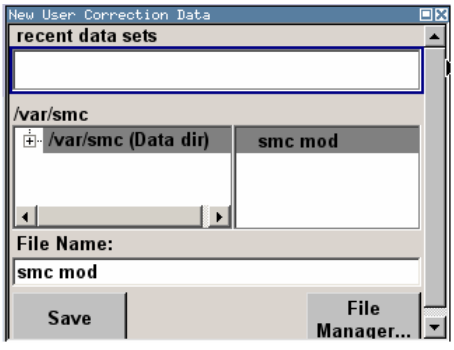


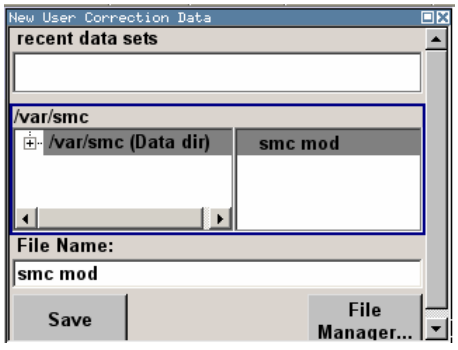


Function	Front panel	PC keyboard	Mouse
Switches on/off	Press rotary knob, ENTER key or a toggle ON/OFF key, if available.	Press Enter key.	Click check box or button.

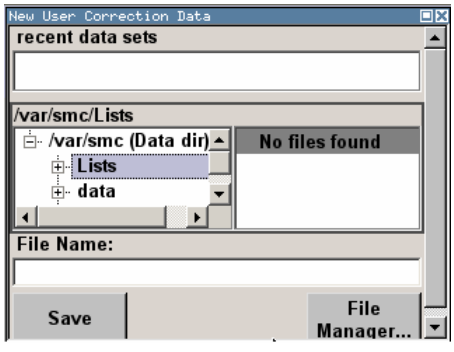
Selecting and Exiting a Menu Area - Setting Parameters

Some menus are organized in areas. The cursor can be moved either only within an area or between the higher-level menu areas. This applies to the **File Select** menus when files are saved or loaded. When the menu is called, one of the menu areas is highlighted by a blue frame.





- Another menu area can be selected (highlighted) by means of the rotary knob or the arrow keys.
- Clicking the rotary knob (= Enter) moves the cursor to the highlighted menu area. When the cursor is placed on a lower-level area in the menu, the area is highlighted by a grey frame. The currently selected item is printed on a blue background (in the example the selected directory).
  The rotary knob and the arrow keys up/down move the cursor only within the grey-framed area.



- Clicking the rotary knob (= Enter) terminates the setting, i.e. selection of a file. The cursor is either set on the next higher menu level or the menu is closed as in our example.
- The left/right cursor keys first shift the entry focus within the menu range form left to right (or vice versa); in the example, from the directory tree to the file list. Press again and the entry focus is shifted up one menu level.Clicking the rotary knob (= Enter) performs a setting.
  In the example of the **File Select** menu, this is the display of the subdirectories if a directory is marked and, if a file is marked, the selection of this file. After a file has been selected, the menu closes automatically.The ESC key moves the cursor to the next higher menu level.

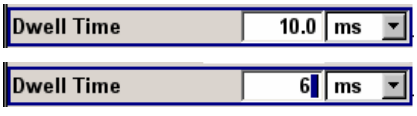
Function	Front panel	PC keyboard	Mouse
Selects a menu area	Select menu area using the rotary knob or the arrow keys. Press the rotary knob or the ENTER key. Rotary knob and arrow keys up/down move the cursor only within the selected menu area.	Select menu area using the arrow keys. Press the Enter key. The arrow keys up/down move the cursor only within the selected menu area.	- (The menu area is selected by selecting an entry.)
Exits a menu area	Press the ESC key. Rotary knob or arrow keys move the cursor between different menu areas.	Press the Enter key. The arrow keys move the cursor between different menu areas.	- (The menu area is exited by setting the cursor on an item outside the area).

Entering a Value - Setting Parameters

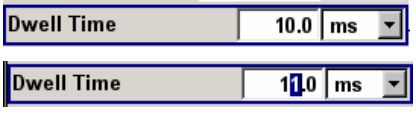
Numeric and alphanumeric values can be edited in the entry fields. In the overwrite editing mode is used.

Numeric values can either be newly entered or the existing value can be varied. Incorrect entries are cleared with the BACK SPACE key.

- **Entering a new value:**
  A click on a numeric key activates the editing mode. The previous value is cleared and the new value can be entered.



- **Variation:**
  Clicking the rotary knob (= Enter) activates the editing mode. Set the cursor to the left of the number to be changed using the left/right arrow keys. The value at the cursor position is varied. An increase or decrease of the value depends on the cursor used (up/down) or on the direction of rotation of the rotary knob.



Alphanumeric values can be newly entered (e.g. file name).

- **New entry:**
  The entry is started by clicking an alphanumeric key.

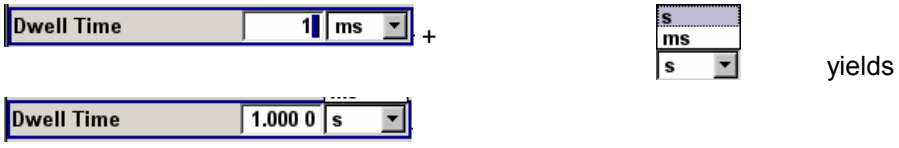
Function	Front panel	PC keyboard	Mouse
Enters a new value	Press an alphanumeric key.	Press a letter key or a numeric key.	-
Edits a value	Click the rotary knob. Select the desired numeric digit with the rotary knob and mark it by clicking the button. Change the number using the keypad.	Press the Enter key. Select the desired numeric digit using the left/right arrow keys. Enter new value using the keyboard.	Click the desired position to set the cursor. Change the value using the keyboard.
Varies a value	Click the rotary knob. Select the desired numeric digit with the rotary knob and mark it by clicking the button. Vary the number using the rotary knob.	Press the Enter key. Select the desired numeric digit using the left/right arrow keys. Vary the number using the up/down arrow keys.	-

Selecting a Unit - Setting Parameters

The entry of a numeric value can be terminated by pressing a unit key on the front panel, selecting a unit in the selection field next to the value or by clicking the rotary knob (= Enter). The unit is assigned in different ways:

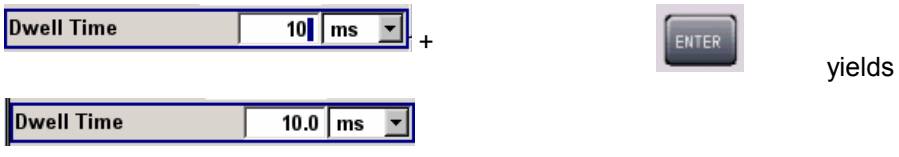
Terminating the value entry by selecting a unit in the units field

When the entry is terminated by selecting a unit in the units field next to the value, the selected unit is assigned, e.g. sym/s (for list selection see next section).



Terminating the value entry with Enter

If an entry is terminated by clicking the rotary knob (= Enter) or with the ENTER key, the unit displayed in the entry field next to the value is assigned (in the example ksym/s).

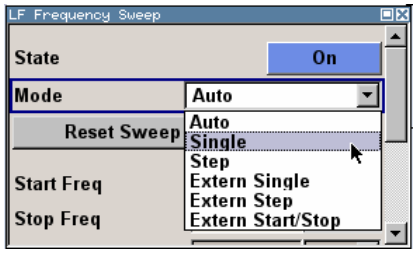


Function	Front panel	PC keyboard	Mouse
Assigns a unit	To terminate the entry, press one of the unit keys or select unit in the field at the right of the value (for list selection see next section).	To terminate the entry press one of the key combinations ALT + F9/ + F10/+ F11/+ F12 or select unit in the field at the right of the value (for list selection see next section).	Select unit in the field at the right of the value **before** entering the value (for list selection see next section).
Changes a unit	After the value entry has been terminated press a unit key or select unit in the field at the right of the value (for list selection see next section).	After the value entry has been terminated press one of the key combinations ALT + F9/+ F10/+ F11/+ F12 or select unit in the field at the right of the value (for list selection see next section).	Select unit in the field at the right of the value **after** the value entry (for list selection see next section).

Selecting a Value from a List - Setting Parameters

The button next to the value field indicates that a selection list is available.

- Clicking the rotary knob (= Enter) opens the list. Selection is made by choosing an entry (item is highlighted) and confirmation with ENTER. If the list is longer than the displayed window, a scroll bar is available



Function	Front panel	PC keyboard	Mouse
Opens the selection list	Press rotary knob or ENTER key.	Press Enter key.	Click button.
Selects an entry	Select entry using the rotary knob or the up/down arrow keys and confirm with the rotary knob or the ENTER key.	Select entry using the up/down arrow keys and confirm with the Enter key.	Double-click the desired entry.
Scrolls	Shift the displayed list section using the rotary knob or the up/down arrow keys.	Shift the displayed list section using the up/down arrow keys.	Press or button in the scroll bar until the desired entry is displayed.

Terminating Entries - Setting Parameters

Variations by means of the rotary knob are immediately set, e.g. RF frequency variation.

All other parameter settings have to be confirmed by a pressing the rotary knob or one of the unit keys (see also section "*Selecting a Unit*", page *3.15*).

Some settings require additional confirmation with the **Accept** button. This is the case when it is useful to first enter a few values and to confirm them together, e.g. when network settings are made. Settings not yet confirmed by **Accept** are displayed in the menu on a yellow background. This indicates that the currently displayed values do not represent the desired signal.

All settings of instrument functions that can be switched on and off are calculated and effective only after this function has been switched on.

This applies to most settings on the R&S SMC. An exception is, for instance, the frequency variation of the reference oscillator, which is immediately set.

Function	Front panel	PC keyboard	Mouse
Accepts value immediately	Vary the value using the rotary knob or the up/down arrow keys.	Vary the value with the up/down arrow keys.	-
Confirms entries	Press rotary knob or ENTER key or press unit key.	Press Enter key or one of the key combinations ALT + F9/+ F10/+ F11/+ F12.	Exit entry field.

Function	Front panel	PC keyboard	Mouse
Confirms entries in the menus with the Accept button.	Press **Accept** button.	Select **Accept** button with the arrow keys and press Enter.	Click **Accept** button.
Sets the entries in the instrument	If the instrument function is active, the new value is immediately calculated and set. If the instrument function is not active, the new, confirmed value is calculated and set only when the function is switched on.	(see front panel)	(see front panel)

Restoring the Previous Value - Setting Parameters

Parameter variations with the rotary knob are immediately set and therefore not reversible.

Normally, values cannot be restored also in the case of mouse control because no explicit confirmation is required in this case and entries are automatically confirmed when the entry or selection field is exited.

In the case of front-panel control or operation from the keyboard, previous values can be restored as long as the new value is not confirmed, i.e. the entry is not completed. This can be done with the ESC key.

Function	Front panel	PC keyboard	Mouse
Restores previous values	Press the ESC key before the entries are confirmed.	Press the Esc key before the entries are confirmed.	-

Menu Operation

Menus are operated with the aid of the Winbar buttons and with the CLOSE and DIAGR keys on the front panel.

- The DIAGR key toggles between block diagram, magnified frequency and level indication and the display of the active menu..
- The CLOSE key closes an active menu.

Note:
The ESC key also closes the active menu if the cursor is at the highest menu level.

Function	Front panel	PC keyboard	Mouse
Displays the block diagram in the foreground	Press the DIAGR key.	Press CTRL + D.	Click function block.
Displays a menu in the foreground	Press the associated button.	Press CTRL + F1 to F8.	Click the respective button in the Winbar.
Closes an active menu	Press the CLOSE key.	Press CTRL + G.	Click the button in the menu bar.
Hides all menus	Click the DIAGR key.	Press CTRL + D.	-

Editors

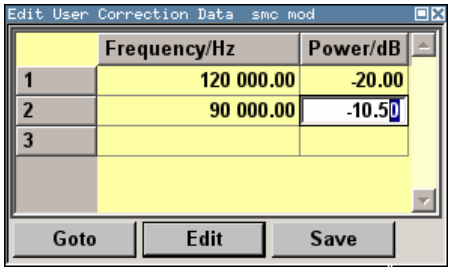
The R&S SMC provides user-friendly editors for defining lists. Lists containing frequency and level value pairs are used for the user-defined level correction.

The lists are saved to files and may thus have any length. The file name of the lists and the directory to which the files are saved are user-selectable. The file prefix is different for each list type and is permanently assigned by the system (see section "*File Management*", page 3.22).

List Editor

The **User Correction** menu provides the list editor for defining the frequency/level value pairs. The associated buttons call up the list editor.

- The selected list is displayed. If no list has been selected, a blank list of only one row is displayed.



- The value pairs are entered in the **Frequency/Hz** and **Power/dBm** table columns. A blank row is inserted at the end of the list.
- New rows can be inserted anywhere in the table by means of the **Insert Row(s)...** button.
- After the list has been edited, i.e. changed, it can be saved under its current name by means of the **Save** button, or under a new name by means of the **Save as...** button. Only complete value pairs are taken into consideration; rows containing an entry in only one column are ignored.
- An existing list can be edited in the insert or overwrite mode.
- A new list can be created under a new name either by generating a blank file in the **File Select** menu (see section "*File Management*", page 3.22) or by changing an existing list which will then be saved under a new name.

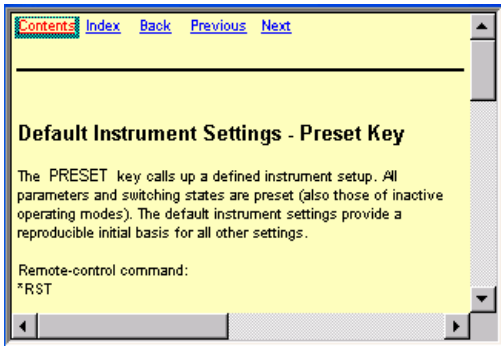
Function	Front panel	PC keyboard	Mouse
Call up editor. The cursor marks the first row of the Frequency/Hz column.	Use the rotary knob or the cursor keys to mark the **Edit User Cor. Data...** button in the individual menu, click the rotary knob or press the ENTER key.	Mark the **Edit User Cor. Data...** button in the individual menu and press the Enter key.	Click the **Edit User Cor. Data...** button in the individual menu.
Enter value.	Use the numeric keys to enter the value and terminate the entry by pressing the unit key.	Use the numeric keys to enter the value and terminate the entry by pressing the Enter key.	-
Change column.	Press the left/right cursor keys.	Press the left/right cursor keys.	Click cell.
Change row.	Use the rotary knob or the up/down cursor keys to mark the row.	Use the up/down cursor keys to mark the row.	Click cell.

Function	Front panel	PC keyboard	Mouse
Select row. The cursor moves to the selected row.	Use the rotary knob or the cursor keys to mark the **GoTo** button, click the rotary knob or press the ENTER key. Enter the row index in the entry field by means of the numeric keys, click the rotary knob or press the ENTER key.	Mark the **GoTo** button and press the Enter key. Use the numeric keys to enter the row index and terminate the entry by pressing the Enter key.	Click cell.
Insert row. A row is inserted above the currently marked row. If no row has been selected, a row is inserted at the beginning of the list.	Select the row above which the new row is to be inserted. Use the rotary knob or the cursor keys to mark the **Insert Row(s)** button, click the rotary knob or press the ENTER key.	Select the row above which the new row is to be inserted. Mark the **Insert Row(s)** button and press the Enter key.	Click the row above which the new row is to be inserted. Click the **Insert Row(s)** button.
Save list under a new name.	Use the rotary knob or the cursor keys to mark the **Save as..** button, click the rotary knob or press the ENTER key. Enter the file name in the **File Select** menu and select the directory.	Mark the **Save as..** button and press the Enter key. Enter the file name in the **File Select** menu and select the directory.	Double-click the **Save as...** button. Enter the file name in the **File Select** menu and select the directory.
Save list under the same name.	Use the rotary knob or the cursor keys to mark the **Save** button, click the rotary knob or press the ENTER key.	Mark the **Save** button and press the Enter key.	Double-click the **Save** button.
Create new list.	Mark the **User Correction Data** button, click the rotary knob or press the ENTER key. Mark **Create New List**, click the rotary knob or press the ENTER key. Enter the file name in the **File Select** menu and select the directory.	Mark the **User Correction Data** button and press the ENTER key. Mark **Create New List** and press the Enter key. Enter the file name in the **File Select** menu and select the directory.	Double-click the **User Correction Data** button. Double-click Create New List. Enter the file name in the **File Select** menu and select the directory.

Help System

The R&S SMC is equipped with a context-sensitive help function. A help page is available for each parameter and can be called any time during instrument operation. The context-sensitive page which is opened with the HELP key is part of a comprehensive help system. It is possible to move from this context-sensitive page to any page of the help system.

Note:
Compiled online help systems are also available for all functions of the R&S SMC on the CD-ROM supplied with the instrument. This help program can be called on any controller with Internet Explorer version V 4.0 and higher.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Back
Previous
Next
Default Instrument Settings - Preset Key
The PRESET key calls up a defined instrument setup. All parameters and switching states are preset (also those of inactive operating modes). The default instrument settings provide a reproducible initial basis for all other settings.
Remote-control command:
*RST

The help function is provided with a navigation bar, i.e. other help pages can be called from the context-sensitive page via the table of contents, the index, arrows for scrolling and page-internal links.

Operation of context-sensitive help

Function	Front panel	PC keyboard	Mouse
Open the help system The help page for the respective parameter is displayed.	Press HELP key.	Press F1 key.	-
Close the help system	Press HELP key again.	Press F1 key again.	-
Activate the link The help system branches to the linked page.	Select link with rotary knob or arrow keys and activate by clicking the rotary knob or ENTER key.	Select link using the arrow keys and activate with the Enter key.	Click link.
Page Up/down	Select **Previous**, **Next** or **Back** in the help window using the arrow keys and activate by clicking the rotary knob or the ENTER key.	Select **Previous**, **Next** or **Back** in the help window using the arrow keys and activate with the Enter key.	Click Previous, Next or Back.
Scroll	Move indicated help window area using the rotary knob and the arrow keys	Move indicated help window area using the arrow keys	Click the scroll bar and move to the desired position.
Select an item in the table of contents The help page of the item is displayed.	Select **Content** in the help window using the arrow keys and activate by clicking the rotary knob or the ENTER key. Select the desired item using the rotary knob or the arrow keys up/down and activate by clicking the rotary knob or the ENTER key.	Select **Content** in the help window using the arrow keys left/right and activate with the Enter key. Select the desired item using the arrow keys and activate with Enter.	Click Content Click item.
Select an index term The help page of the term is displayed.	Select **Index** in the help window using the arrow keys and activate by clicking the rotary knob or the ENTER key. Select the desired item using the rotary knob or the arrow keys up/down and activate by clicking the rotary knob or the ENTER key.	Select **Index** in the help window using the arrow keys left/right and activate with the Enter key. Select the desired item using the arrow keys and activate with Enter.	Click Indext Click item.

File Management

The R&S SMC uses files to save all instrument data, i.e. system and user data. The user data includes saved instrument settings and lists for the user correction.

The files are stored in the internal memory of the instrument or on a USB memeory stick. The /var directory can be used to save user-defined data; any subdirectory structure can be created on /var. Some default subdirectories are predefined, but can be changed at any time.

The /opt directory is a protected and therefore unaccessable system directory. The files on this directory contain data that must not be changed. Therefore, this directory should not be accessed, since reconstruction of the system partition will lead to data loss. To prevent inadvertent deletion or overwriting of system files, this directory is not specified in the file menus.

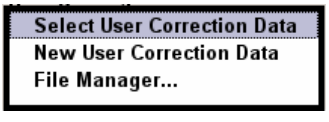
Files can be exchanged via a memory stick. The memory stick has to be connected to the USB interface and accessed via the **File** menu.

The files are accessed in a **File Select** window in the individual menus. Depending on the data type, a file can either be selected or it can be selected and saved:

- Instrument settings can be saved and loaded. In case of saving, the current setting is saved to the specified file.
- Lists, e.g. user correction lists, can be loaded. They can be generated either externally or internally. For internal generation, a new list must be created in the **File Select** window which will then be edited in the list editor of the individual menu.

  The files are differentiated according to their extensions; each type of file is assigned a specific file content. The extension is usually of no consequence to the user since access to the files occurs in the individual menus where only the relevant type of file is available.

A button in the individual menu calls up the selection of the **Select/New** and **File Manager** functions.



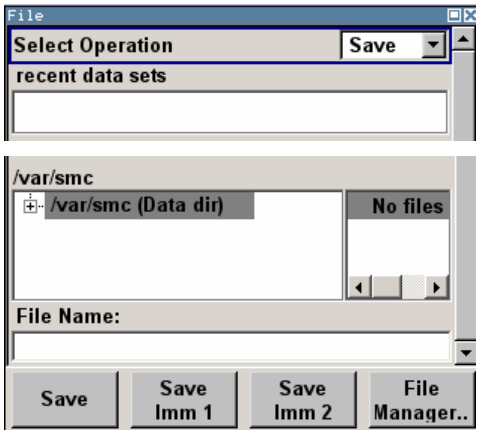
After the **Select/New** selection, a **File Select** window for loading, saving or creating a file is displayed (see the following section "*File Select Menu*", page 3.23).

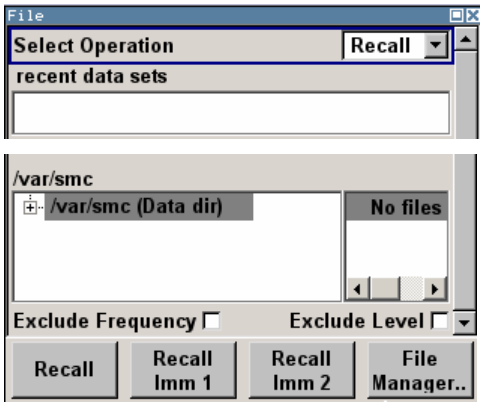
After the **File Manager** selection, a menu for managing all files is displayed (see section "*File Manager*", page 3.24).

The complete instrument settings are saved and loaded in the **File** menu which is called up by means of the File key (see chapter 4, section "*Storing and Loading Instrument Data*").

File Select Menu

The **File Select** menu consists of several areas.





In the upper area, **Recent Data Sets**, the files last used are listed; a maximum of ten files is displayed.

The available drives and directories are displayed on the left side, the files of the selected directory on the right side. The currently selected path is displayed above the windows. Only the relevant files without file extensions are displayed. If the area is opened several times, the path last selected is displayed.

When a file is saved or created, its name is user-selectable; the extension is assigned automatically and cannot be entered. The file is saved to the selected path.

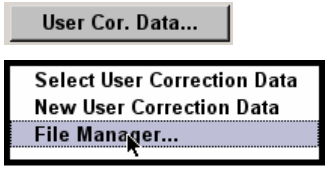
Operation is similar to the operation of menus with several areas (see section "*Selecting and Exiting a Menu Area - Setting Parameters*", page *3.13*): By using the rotary knob or cursor keys, the area is marked; the entry focus is shifted to this area by clicking the rotary knob or using the Enter key. The rotary knob and the up/down cursor keys will then navigate only within this area. By using the left/right cursor keys, it is possible to switch between the directory tree and the file list. The subdirectories of the selected directory will only be displayed after a short delay to allow quick navigation in the directory tree. Pressing the ESC key again shifts the entry focus up one level. The button for saving or loading the file can be selected and pressed. After the setting, e.g. after selecting the file, the menu will be closed automatically.

- **Load file:**
  Mark file and load it by clicking the rotary knob or by pressing the **Select** button/softkey.
- **Save file:**
  Enter file name in the **File Name:** field. Mark the directory to which the file is to be saved and then click the **Save** button/softkey.
- **Create file:**
  Enter file name in the **File Name:** field. Mark the directory to which the file is to be saved and then click the **Create** button/softkey. The created file is empty; it must be filled with the necessary values in the individual editor.

File Manager

The **File Manager** allows general file management such as copying, shifting, renaming and deleting files as well as generating new directories.

The **File Manager** can be called up in any menu to which files can be saved. Call-up is either at the level of the small selection menu



or via the **File Manager** button in the **File Select** window.

The File Manager can also be called up in the **Save/Recall - Setup-Settings** menu.

In the upper area, **File Type**, the **File Manager** allows the type file selection to be displayed. This can be used to process either all files (all files (*:*) selection) or a specific selection of files (e.g. user correction (*.ucor) selection). The table at the end of this section contains a list of the file types.

The available drives and directories are displayed on the left side, the files of the selected directory on the right side. The currently selected path is displayed above the windows. If the area is opened several times, the path last selected is displayed. Unlike the **File Select** window, the **File Manager** displays the full file names including extensions.

The buttons trigger the associated actions such as copying, shifting or deleting the marked files. Plus, a new directory can be created in the level below the marked directory.

Operation is similar to the operation of menus with several areas (see section "*Selecting and Exiting a Menu Area - Setting Parameters*", page 3.13): By using the rotary knob or cursor keys, the area is marked; the entry focus is shifted to this area by clicking the rotary knob or using the Enter key. The rotary knob and up/down cursor keys will then navigate only within this area. By using the left/right cursor keys, it is possible to switch between the directory tree and the file list. The subdirectories of the selected directory will only be displayed after a short delay to allow quick navigation in the directory tree. Pressing the ESC key again shifts the entry focus up one level. The buttons/softkeys can be selected and activated.

- **Shift file:**
  Mark file and then press the **Cut** button/softkey. Mark the directory to which the file is to be shifted and then click the **Paste** button/softkey. If the target directory already contains a file with the same name, a confirmation query is displayed to confirm overwriting of this file.
- **Copy file:**
  Mark file and then press the **Copy** button/softkey. Mark the directory to which the file is to be copied and then click the **Paste** button/softkey. If the target directory already contains a file with the same name, a confirmation query is displayed to confirm overwriting of this file.
- **Rename file:**
  Mark file and then press the **Rename** button/softkey. An entry window for entering the new file name opens. Enter the name and press the Enter key. If a file with the same name already exists, a confirmation query is displayed to confirm overwriting of this file.

- **Delete file:**
  Mark file and then press the **Delete** button/softkey. Prior to deletion, a confirmation query is displayed which the user must confirm for this file to be deleted.
- **Create new directory:**
  Mark drive or directory level where the new directory is to be created and then press the **Create New Directory** button/softkey. An entry window for entering the directory name opens. Enter the name and press the Enter key.

Table 3-1 List of file extensions for user files the R&S SMC assigns automatically

List type	Contents	File suffix
Instrument State	Instrument settings	*.savrcl
User Correction	User-defined level correction values	*.uco

Remote Access

The R&S SMC can be remote-accessed from an external PC. This allows convenient operation of the Signal Generator from the desktop although the instrument is integrated in a rack somewhere else.

Remote access in contrast to **remote control** does not use remote-control commands but the regular user interface displayed using separate software which is installed on the external PC. The instrument can thus be manually operated from the PC as on the unit itself.

Preconditions for remote access are a connection between signal generator and PC via a LAN network and the installation of the VNC client software on the PC and on the R&S SMC.

Establishing the connection and installation of the remote-control software on the external PC is described in chapter 1, section "*Connecting the R&S SMC to a Network (LAN)*".

After the connection is established, the current signal generator screen with the block diagram is displayed and the R&S SMC can be remote-accessed from the external PC. The individual functions are operated using the mouse and keyboard. Specific instrument functions can be executed using specific key combinations on the keyboard. Front-panel keys which are not directly available on the keyboard can be substituted by key combinations or by the front panel key emulation panel (see next section).

When the connection is set up, direct control on the R&S SMC is possible while manual remote-control is established, it can be performed alternately with the remote access.

For return to direct operation on the R&S SMC, the connection must be closed. After closing the connection, it is still enabled and can be established again any time (see chapter 1, section "*Remote Access via an External Controller*").

Legend of Front-Panel Controls

The following table lists all key functions available on the front panel. Key combinations used on the PC keyboard to trigger key functions on the instrument front panel are also described. Keyboard labels are described in alphabetical order.

In addition, a front panel key emulation and an on-screen keyboard can be used for manual operation by mouse only (see below).

Front-panel key	Key of PC keyboard	Function
	Tab key (towards the right) Shift + Tab (towards the left)	Sets the cursor with the rotary knob.
	Enter	Pressing the rotary knob confirms an entry; it has the same function as the ENTER key.
↑ ↓ → ←	Arrow keys	Moves the cursor.
Enter / dB(m)	ALT + F12	Confirms entries in the base unit and values without a unit. Selects dBm for the RF level and dB for level offset and level step width.
. / *...#	. / *...#	Enters a period/decimal point. Enters a special character.
+/- / A↔a	- / (shift+) a—z	Enters the sign. Switches between upper-case and lower-case letters.
0-9 / a...z	CTRL+ 0-9 / a...z CTRL	Enters the number/letter.
BACKSPACE	Backspace	Clears the last entry (number, sign or decimal point)
CLOSE	CTRL + G	Closes an active menu.
DIAGR	CTRL+ D	Sets the cursor on the block diagram and hides all menus.
ENTER	Enter	Terminates an entry.
ESC	ESC	Selects the next higher menu/selection level. When the editing mode is exited with ESC, the previous value is restored.
FREQ	CTRL+ F	Activates the frequency entry.
G/n / dBµV	ALT + F9	Selects the unit Giga/Nano, dBµV for the RF level and dBu for the LF level.
HELP	F1	Opens/closes context-sensitive help.
INFO	CTRL + I	Opens/closes the info window.
k/m / µV	ALT + F11	Selects the units Kilo/Milli and µV for RF levels.
LEVEL	CTRL + L	Activates the level entry.
LOCAL	CTRL + Q	Switches the instrument from remote control to manual control.
M/µ / µV	ALT + F10	Selects the units Mega/Micro and µV for RF levels.
MOD ON/OFF	CTRL + O	Switches modulation on/off. MOD OFF is indicated in the status line.
PRESET	CTRL + P	Restores a defined basic instrument setup.
RF ON/OFF	CTRL + R	Switches the RF output signal on/off. RF OFF is indicated in the status line.
SETUP	CTRL + E	Opens the setup menu for general instrument settings.

Front Panel Key Emulation

The R&S SMC provides a front panel key emulation to enable execution of the front panel key functions by mouse e.g. for remote access. The emulation is called by a right mouse click. The front panel key functions are executed by a mouse click on the associated button.

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4 Instrument Functions

This chapter explains the functions of the signal generator and the options available in the setting menus. The associated IEC/IEEE-bus command is specified for each parameter (where applicable).

The description begins with the general instrument settings which do not directly affect signal generation. The majority of these settings can be accessed by means of front-panel key menus and not by means of function block menus.

The signal generation functions are then described, beginning with the functions which affect the RF signal (**RF** block) and the analog modulations (**Mod** block). The configuration of the modulation generators (LF generators and pulse generator) and of the LF sweep is offered in the **Mod Gen** block.The general instrument settings include various functions, such as:

- Setting a defined basic setup using the PRESET key
  (section "*Default Instrument Settings - Preset Key*", page 4.6)
- Switching from remote control to manual control using the LOCAL key
  (section "*Switching to Manual Control - Local Key*", page 4.31)
- Configuring the generator and its interfaces in the **Setup** menu - e.g. setting the IEC/IEEE-bus address, starting an adjustment, querying instrument data
  (section "*General Configuration of Instrument - Setup Key*", page 4.8)
- Calling up the online help using the HELP key
  (section "*Help System - Help Key*", page 4.32)
- Querying messages using the INFO key
  (section "*Messages - Info Key*", page *4.31*)

The RF signal is configured in the **RF** function block:

- CW mode
  (section "*RF Signal - RF*", page 4.39)
- Frequency and Level Sweep mode
  (section "*Sweep Mode*", page4.66)

The analog and external digital modulations are activated in the **Mod** function block:

- Amplitude Modulation
  (section "*Amplitude Modulation - AM*", page 4.81)
- Frequency Modulation
  (section "*Frequency Modulation - FM*", page 4.83)
- Phase Modulation
  (section "*Phase Modulation - PhiM*", page *4.86*)
- Pulse Modulation
  (section "*Pulse Modulation*", page *4.88*)

The internal LF generators, the LF frequency sweep and the pulse generator is configured in the **Mod Gen** function block:

- LF Frequency Sweep
  (section "*LF Frequency Sweep Menu*", page 4.92)
- LF Output
  (section "*LF Output Menu*",page 4.98)

General Instrument Settings

Overview of General Instrument Settings

The section "General Instrument Settings" describes the settings which do not directly affect signal generation. Most of these settings can only be accessed by means of menus which are opened using the front panel key.

The general instrument settings affect various functions, such as storing instrument settings or setting the IEC/IEEE-bus address in the setup menu using the SETUP key. The order in which the descriptions are given corresponds to the layout of the keys on the front panel of the R&S SMC (from top left to bottom right).

Default Instrument Settings - Preset Key

The PRESET key calls up a defined instrument setup. All parameters and switching states are preset (also those of inactive operating modes). The default instrument settings provide a reproducible initial basis for all other settings.However, functions that concern the integration of the instrument into a measurement setup are not changed, e.g. IEC/IEEE bus address or reference oscillator source settings.

Note:
Resetting the instrument to the factory state is possible in the ***Factory Preset - Setup Settings*** *menu.*

Remote-control command:
*RST

When the instrument is switched on, it is not the preset state that is active, but rather the instrument state that was set before the instrument was switched off. An exeption is the state of the RF output. The state of the RF output power-on state can be set to be always off in the **EMF** menu of the RF block.

User-defined instrument states can be stored and called up in the **File** menu.

The following table gives an overview of the presets for the most important generator settings. The other presets can be found in the information accompanying the IEC/IEEE-bus commands (Chapter "*Remote Control Commands - Description*").

The list below the table shows the settings that are not affected by the PRESET key.

Table 4-1 Preset state - important generator settings

Setting	Preset value
RF frequency	1 GHz
RF level	RF output switched o
Offsets	0
Modulations	Switched o
Uninterrupted level setting	Switch o; level attenuator mode: AUTO
Internal level control	Level ALC: AUTO
User correction	Level Ucor: O
LF output	Switched o
Sweep	Switched o

Settings that are not affected by the PRESET key

- Reference frequency settings (Ref Oscillator menu)
- Power on settings (Level/EMF menu)
- Network settings (Setup menu)
- IEC/IEEE-bus address (Setup menu)
- *IDN? identification (Setup menu)
- Password and settings protected by passwords (Setup menu)
- Start/Stop Gui Update (Setup menu)
- Display settings (Setup menu).

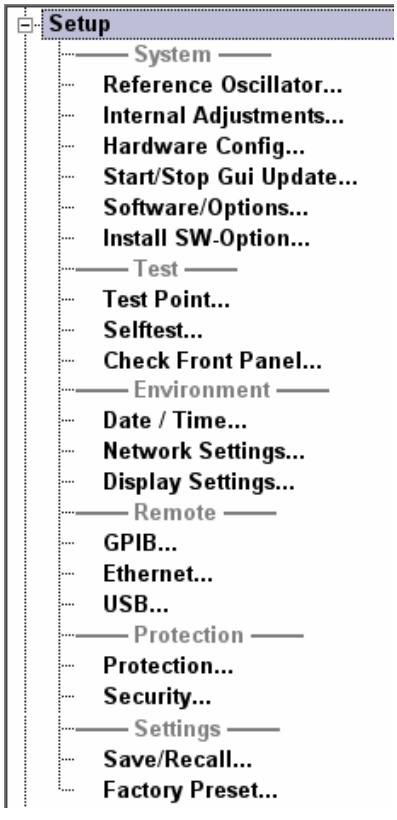
General Configuration of Instrument - Setup Key

The SETUP key opens the **Setup** menu. The Setup menu is divided into several sections.

- The **System** section is used to set general instrument parameters.
- The **Test** section is used to perform function tests.
- The **Environment** section is used to configure the controller interfaces.
- The **Remote** section is used to configure the remote control interfaces.
- The **Protection** is used to set the protection level for service functions.
- The **Settings** section contains the **Save/Recall** menu.

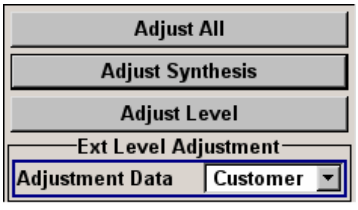
Most submenus of this key can be accessed only via the SETUP key, with the following exception:

- The **Reference Oscillator** submenu can also be called up in the **RF** block and is therefore described in the section on this block (see section "*RF Reference Frequency - Reference Oscillator*", page 4.44).



Internal Adjustments - Setup-System

The R&S SMC Signal Generator is extremely accurate thanks to the integrated procedures for adjustments.



All internal adjustments for which no external measuring equipment is needed can be started in the **Internal Adjustments...** menu. The adjustments with external measuring equipment are described in the Service Manual (on CD ROM, supplied with the instrument).

Adjustment is recommended if the temperature range in which the instrument is operated changes, or prior to all applications which require maximum level and frequency accuracy.

During adjustment a bar indicates the status of progress. If an error occurs, adjustment is terminated and an error message is output in the info line.

NOTICE **Risk of invalid adjustment**

In order to achieve correct adjustment of the instrument, make sure that the instrument is warm before performing adjustments. The warm-up time is 30 minutes.

The **Internal Adjustments** menu under **System** is opened up using the SETUP key.

Adjust All

Starts all internal adjustments for which no external measuring equipment is needed. The adjustments with external measuring equipment are described in the Service Manual (supplied).

Remote-control command:
`CAL:ALL?`

Adjust Synthesis

Performs all adjustments which affect the frequency.

Remote-control command:
`CAL:FREQ:MEAS?`

Adjust Level

Performs all adjustments which affect the level. The correction values improve the settling time and the signal quality.

Remote-control command:
`CAL:LEV:MEAS?`

Adjustment Data

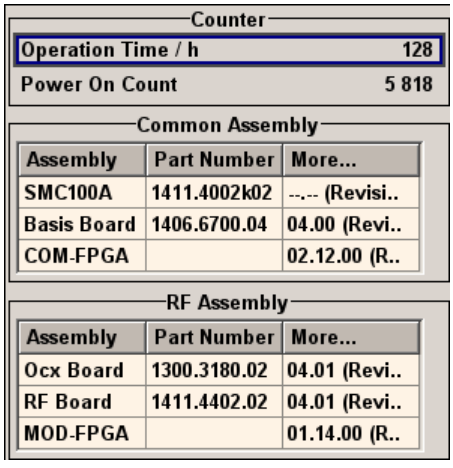
Selects the data used for external level correction.

By default the instrument uses correction data obtained in the factory before delivery. In addition, customer data can be used for external level correction. The customer data is obtained using a R&S NRP power sensor. External level correction is a protected function (see service manual, chapter 2, "Adjustment").

Remote-control command:
`CAL:LEV:EXT:DATA FACT`

Hardware Config... - Setup-System

In the **Hardware Config…** menu, the installed assemblies together with their variants and revision states can be displayed for servicing purposes. The **Hardware Config** menu under **System** is opened using the SETUP key.



Section **Counter** in the upper part of the menu shows the **Operation Hours** and the number of power-on (**Power On Counter**).

Remote-control command:

```
DIAG:INFO:OTIM?      Response:    "37"
DIAG:INFO:POC?       Response:    "147"
```

A table below lists the installed assemblies. It is divided into the sections **Common Assembly** and **RF Assembly** and **Baseband Assembly**

Assembly	Assembly name
Part Number	Part Number of assembly
More…	Opens a dialog with additional information on serial number, revision and slot of assembly and used bus by assembly (serial bus or PCI bus).

Remote-control command (see chapter 'Remote control Commands' for parameter name for modules):

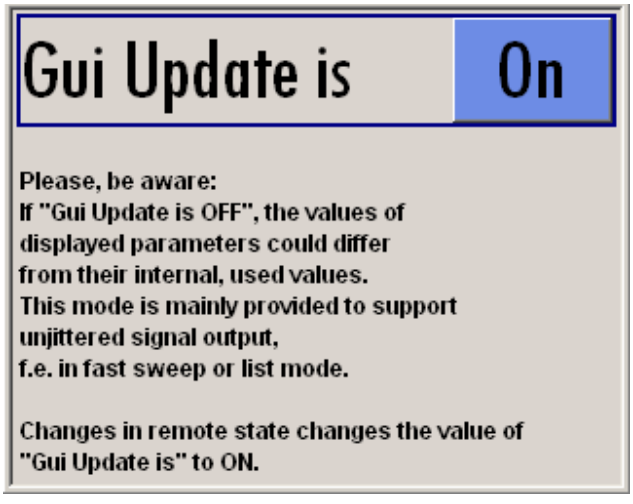
```
DIAG:BGIN?  "RFBO"  Response: "1406.7007.00 02.00 123456,MOD-FPGA 20.20.00 "
```

Gui Update... - Setup-System

In the **Start/Stop Gui Update...** menu the update of the displayed parameters can be switched off in order to increase speed for certain settings.

Note:
It is especially recommended to switch off the GUI update for optimum sweep performance with short dwell times and for fast settling times.

The indicated values are not updated and may therefore differ from the internally used values.


Gui Update is
On
Please, be aware:
If "Gui Update is OFF", the values of
displayed parameters could differ
from their internal, used values.
This mode is mainly provided to support
unjittered signal output,
f.e. in fast sweep or list mode.
Changes in remote state changes the value of
"Gui Update is" to ON.

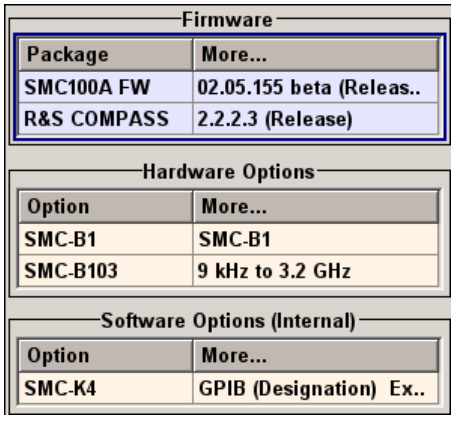
Remote-control command:
`SYST:DISP:UPD OFF`

Software / Options... - Setup-System

The **Software / Options...** menu shows the firmware version of the instrument software as well as all installed hardware and software options.

Note:
Software options purchased at a later stage can be activated with a key code. The activation code is supplied with the software option. How to install options is described in Chapter 4 of the Service Manual (on CD ROM supplied with the instrument). The installation of hardware options purchased at a later stage is also described in Chapter 4 of the Service Manual (supplied with the instrument). Most hardware options need to be installed at an authorized Rohde&Schwarz service shop.

The **Software / Options** menu under **System** is opened using the SETUP key.



Remote-control commands:

```
*OPT?
```

Response:

```
"SMC-B103, SMC-K4 ...."
```

```
*IDN?
```

Response:

```
"Rohde&Schwarz,SMC,1411.4002k02/342988,2.02.0.0 (Release)"
```

The **Firmware** section of the menu shows the firmware version and the version of the software platform.

Note:

*Your R&S SMC is delivered with the latest firmware version available. Firmware updates as well as the Release Notes describing the improvements and modifications are provided on the Internet at the download site of the Rohde & Schwarz SMC home page (*http://www.rohde-schwarz.com/product/smc100a*). This home page always offers the latest information on your signal generator, e.g. also on* ***changes of the firmware update procedure****.*

The tables in the sections **Hardware** and **Software** list the installed hardware and software options.

Option	Short name of option
More…	Opens a dialog with additional information, e.g. on designation, license number, and expiration date of option For regular options, **Permanent** is indicated in this column. Some options are available as trial versions. This column shows their expiration date. After this date, the option is no longer available on the instrument.

Section **Loaded Modules** is provided for service purposes. It lists all loaded software modules with their versions and offers a short description of each module.

Install SW-Option... - Setup-System

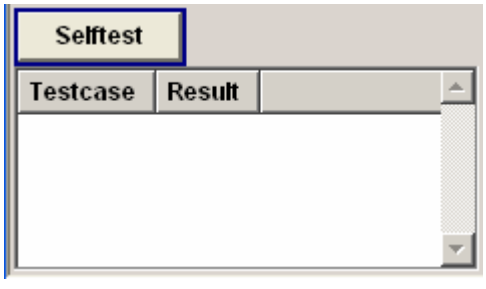
Newly purchased software options are enabled in the **Install SW-Options...** menu.. They are ready to operate after they are enabled by means of a key code supplied with the option.

Only if the R&S SMC Signal Generator is equipped with an older firmware version, a firmware update prior to enabling the software option may be required. The information on the valid firmware versions for the purchased software option is provided together with the option. The firmware update is described in the service manual instrument, chapter 4 (on CD ROM, supplied with the instrument).

Self Test

A self test is provided by the instruments´ firmware. Several diagnostic points are checked to verify the correct values and functions of the instrument.

The **Selftest...** dialog is called by using the SETUP key.



Selftest

Performs the selftest. The Testcase/Result window lists the tested diagnostic points as well as the test results, either succeeded (PASSED) or failed (FAILED).

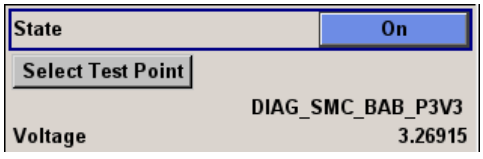
Remote-control command: n.a.

Test Point... - Setup-Test

The **Test Point...** menu provides access to the test points available in the instrument. Test Point is a protected procedure, which can be accessed if protection level 1 is disabled. The protection dialog is called in the setup menu (see *Protection - Setup-Protection*, page 4.21).

When activated, the voltage of the selected test point is measured and displayed. A detailed description of the test points can be found in Chapter 3 of the Service Manual which is supplied with the instrument.

The **Test Point...** menu under **System** is opened using the SETUP key.



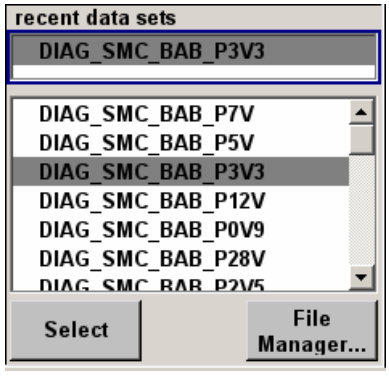
State Test Point

Activates the measurement of the voltage at the selected test point.

Remote-control command:
DIAG1:MEAS:POIN? 'DIAG_NO_DP'
Response: 2

Select Test Point

Calls the submenu for selecting the test point. The currently selected key is shown next to the key.



Remote-control commands:
DIAG1:POIN:CAT? (Command lists all test points)
DIAG1:POIN? 'DIAG_SMC_BAB_P7V'

With remote control, voltage measurement starts as soon as the test point is selected.

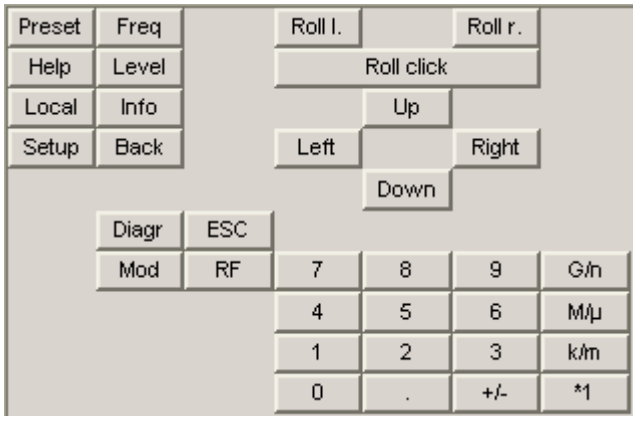
Voltage Test Point

Displays the measured voltage measurement at the selected test point.

Remote-control command:
DIAG1:MEAS:POIN? 'DIAG_SMC_BAB_P7V'
Response: 2

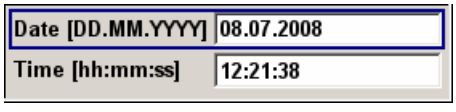
Check Front Panel - Setup-Test

The **Check Front Panel** menu**..** is used to check whether the front panel keys are working correctly. The menu displays all the front panel keys arranged in the same way as on the front panel. The respective function is executed by pressing the associated key.



Date and Time - Setup-Environment

The **Date/Time...** menu provides access to the system time and date settings. It is opened using the SETUP key under **Environment**. The time is used on the internal controller.



Date

Enters the date in the format day.month.year.

Remote-control command: SYST:DATE 2007,03,20

Time

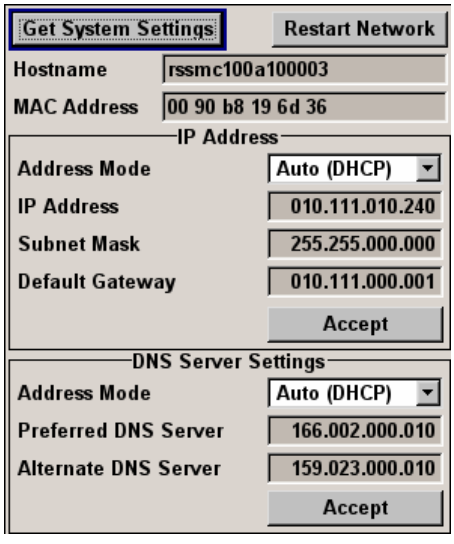
Enters the time in the format hour.minute.second.

Remote-control command: SYST:TIME 23,59,59

Network Settings - Setup-Environment

The **Network Settings...** menu provides access to the network settings. It is opened using the SETUP key under **Environment**. The R&S SMC is equipped with a network interface and can be connected to an Ethernet LAN (local area network). How to connect the signal generator to the network is described in chapter 1, section "*Connecting the R&S SMC to a Network (LAN)*".

NOTICE **Risk of network errors!**
Connecting errors may affect the entire network.
We recommend to coordinate the connection of the instrument to the network with the network administrator.



The menu is divided into the sections **Common Settings** where the general network environment is defined, **IP Address** section where the specific identification of the computer in the network is defined, and **DNS Server Settings** where the DNS server is entered.

New entries are only accepted after the **Accept** button is pressed.

Accept - Network Settings

Accepts a new entry or selection and changes the settings accordingly.

Remote-control command:
`SYST:COMM:NETW:DNS:SET`
`SYST:COMM:NETW:COMM:SET`
`SYST:COMM:NETW:IPAD:SET`

The indications of the menu are only updated after pressing the **Get System Settings** button.

Get System Settings

Retrieves the current system settings of the instrument.

The indications in the network menu are only updated after pressing this button.

Remote-control command: `SYST:COMM:NETW:GET`

Restart Network

Shuts down the network connection of the instrument amd subsequently re-establishes the connection. This function can be used top solve network problems.

Note:
Only the connection of the instrument to the network restarts, the network itself is not affected.

Remote-control command: n.a.

Hostname

Enters the individual computer name of the R&S SMC.

Note:
The computer name can only be changed after protection level 1 is deactivated (see section "Protection - Setup-Protection")

A new entry is only accepted and the hostname changed after the **Accept** button is pressed.

A predefined name is indicated and can be used for network connections.

Remote-control command:
`SYST:COMM:NETW:HOST RSSMC100A123456`

MAC Address

Indicates the MAC address of the network adapter.

Remote-control command:
`SYST:COMM:NETW:MAC?`

Mode

Selects if the IP address is assigned automatically or manually or if a Peer to Peer connection is used.

The selection is only accepted after the **Accept** button is pressed.

Auto (DHCP)

The IP address is assigned automatically.

The network used must support automatic assignment of IP address (DHCP) in order to use this function.

Remote-control command:
`SYST:COMM:NETW:IPAD:MODE AUTO`

Static

The IP address is assigned manually.

Remote-control command:
`SYST:COMM:NETW:IPAD:MODE STAT`

Peer-to-Peer

A Peer to Peer connection is used.

Remote-control command:
`SYST:COMM:NETW:IPAD:MODE P2P`

IP Address

Only for Static and Peer to Peer mode.

Enters the IP address manually.

The new entry is only accepted and the IP address changed after the **Accept** button is pressed.

Remote-control command:
`SYST:COMM:NETW:IPAD 7.8.9.10`

Subnet Mask

Only for Static and Peer to Peer mode.

Enters the Subnet mask.

This number is used together with the IP address to identify the network segment the instrument is in.

The new entry is only accepted and the subnet mask changed after the **Accept** button is pressed.

Remote-control command:
`SYST:COMM:NETW:IPAD:SUBN:MASK 255.255.255.0`

Def Gateway

Only for Static mode.

Enters the IP address of the default gateway.

The new entry is only accepted and the default gateway is changed after the **Accept** button is pressed.

This address identifies the router on the same network as the instrument that is used to forward ttraffic to destinations beyond the local network.

Remote-control command:
`SYST:COMM:IPAD:NETW:GAT  456`

DNS Server Address Mode

Selects if the DNS server address is assigned automatically or manually.

The selection is only accepted after the **Accept** button is pressed.

Auto (DHCP)

The DNS server address is assigned automatically.

The network used must support automatic assignment of address (DHCP) in order to use this function.

Remote-control command:
`SYST:COMM:NETW:DNS:MODE AUTO`

Static

The DNS server address is assigned manually.

Remote-control command:
`SYST:COMM:NETW:DNS:MODE STAT`

Preferred DNS Server

Only for Static mode.

Enters the preferred DNS server address manually.

The new entry is only accepted and the preferred DNS server address changed after the **Accept** button is pressed.

Remote-control command:
`SYST:COMM:NETW:DNS:PREF 7.8.9.10`

Alternate DNS Server

Only for Static mode.

Enters the alternate DNS server address manually.

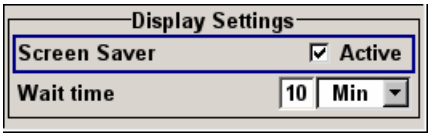
This server is used if the DNS server specified in **Preferred DNS Server** is unreachable.

The new entry is only accepted and the alternate DNS server address changed after the **Accept** button is pressed.

Remote-control command:
`SYST:COMM:NETW:DNS:ALT 7.8.9.10`

Display Settings - Setup-Environment

The **Display Settings...** menu provides access to the settings for the display. It is opened using the SETUP key under **Environment**.



Screen Saver

Activates/deactivates the screen saver of the instrument display. If activated, the display lamp is shut off when no entries via front panel, external mouse or external keyboard are made for a period of time (**Wait Time)**. The screen saver prolongs the life time of the display lamp.

This mode is recommended for preserving the display especially if the instrument is exclusively operated via remote control.

Remote-control command:
`DISP:PSAV:STAT ON`

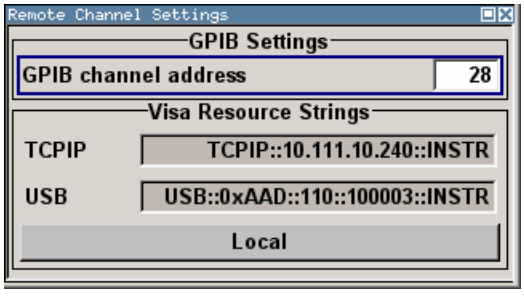
Wait Time

Enters the idle time that must elapse before the display lamp is shut off when no entries are made.

Remote-control command:: `DISP:PSAV:HOLD 10`

Remote Channel Settings - Setup-Remote

The **Remote GPIB/Ethernet...** menu provides access to the GPIB and Ethernet settings. The **Remote GPIB...** menu is opened using the SETUP key under **Remote**.



GPIB channel address

Sets the IEC/IEEE-bus address of the instrument.

Remote-control command:
`SYST:COMM:GPIB:ADDR 28`

Visa Resource String

Indicates the visa resource string. This string is used for remote control of the instrument. A separate string is provided for remote control via the LAN and the USB interface

Remote-control commands:
`SYST:COMM:NETW:RES?`
Response: `TCPIP::192.1.2.3::INSTR`
`SYST:COMM:USB:RES?`
Response: `USB::54::000000::INSTR`

Local - Remote Channel Settings

Switches the instrument to operate in local control mode.

Switching from remote to local control mode can be also done with one of the following actions:

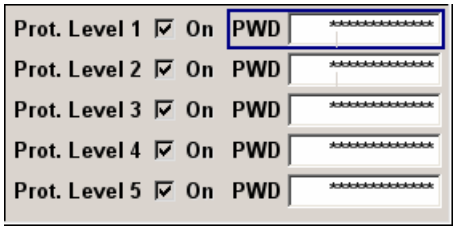
- manually with the LOCAL key on the front panel
- with the interface command **`&GTL`** via the remote-control interface
- with the key combination CTRL + Q

Remote-control command: `n.a.`

Protection - Setup-Protection

The **Protection** menu provides access to the unlocking of protected service functions (authorized personnel of R&S Service Departments only). To deactivate the protection, the correct password has to be entered. After the instrument has been switched on, the protection levels 1 to 5 are automatically activated.

Protection Level 1 can be deactivated to expand the functionality of the internal adjustment, to change the host name and to access the self tests (see service manual). The password is 123456.



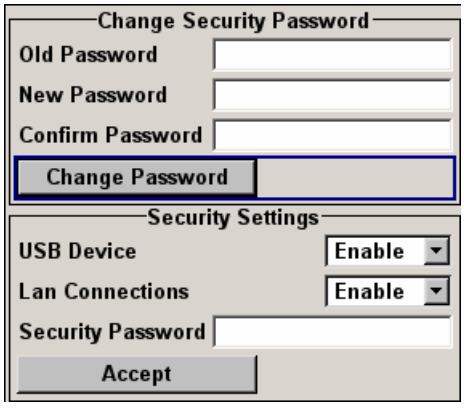
Remote-control command:
`SYST:PROT1:STAT ON`
`SYST:PROT1:STAT OFF, 123456`

Security - Setup-Protection

The **Security...** menu provides access to the passwords and mass storage security settings. It is opened using the SETUP key under **Environment**.

The menu is divided into the password sections and the security settings section. In the password section the passwords for securing a controlled access to the instrument are defined and changed. In the security section the remote interfaces are enabled and disabled.

A change of passwords for the operating system and security password requires the entry of the old and new password and the conformation of the new password. All settings are only accepted after the **Accept** button is pressed.



Accept - Security Settings

Accepts a new entry or selection and changes the settings accordingly.

Remote-control command: `n.a.`

User Name

Indicates the user name used for access to the operating system Linux.

Remote-control commands: `n.a.`

Old password - User

Enters the currently used password. Default is "root".

Remote-control commands: `n.a.`

New Password - User

Enters the new password.

Remote-control commands: `n.a.`

Confirm New Password - User

Enters the new password for conformation.

The new password is only valid after the **Change Password** button is pressed.

Remote-control commands: `n.a.`

New Password - VNC

Enters the new password. The VNC password is required for remote access to the instrument via *Ultr@VNC* (see chapter 1).
The default password is "instrument".

Remote-control commands: `n.a.`

Confirm New Password - VNC

Enters the new password for conformation.

The new password is only valid after the **Change Password** button is pressed.

Remote-control commands: `n.a.`

Old password - Security

Enters the currently used password. Default is '123456'.

The security password is required when changing the status of the USB and LAN interface.

Remote-control commands: `n.a.`

New Password - Security

Enters the new password. Only numerics are permitted.

Remote-control commands: `n.a.`

Confirm New Password - Security

Enters the new password for conformation.

The new password is only valid after the **Change Password** button is pressed.

Remote-control commands: `n.a.`

USB Device - Security

Enables/disables the USB interfaces. Any device connected to the USB interface is not recognized by the instrument when the interface is disabled.

The setting requires the entry of the security password and is only accepted after the **Accept** button is pressed.

Remote-control commands: `n.a.`

LAN Connection - Security

Enables/disables the LAN interfaces. Any device connected to the LAN interface is not recognized by the instrument when the interface is disabled.

The setting requires the entry of the security password and is only accepted after the **Accept** button is pressed.

Remote-control commands: `n.a.`

Security Password

Enters the security password that is required to enable or disabled the LAN or USB interface. Default is '123456'.

All settings are only accepted after the **Accept** button is pressed.

Remote-control commands: `n.a.`

Save Recall - Setup-Setting

The Signal Generator allows complete instrument settings to be stored in files either on the internal flash memory or on external USB memory devices. Defined and complex instrument settings can then be reproduced at any time by loading this data. If required, these settings can be loaded to various signal generators.

The Save / Recall menu in the Setup-Settings menu is used to store and load instrument settings in a file. Additionally there are three intermediate memories in which the current instrument setting can be stored and then called up again by just pressing a key. This makes it possible to switch quickly between defined instrument settings.

All settings which differ from the preset plus the configuration data for the operating elements (e.g. window positions) are stored. When loaded, these referenced settings are implemented and all non-referenced parameters are set to the associated preset value. As a result the files remain relatively small since they only contain the relevant information. Furthermore, this also allows instrument settings to be transferred easily between different signal generators since once again only the settings which differ from the preset values have to be adjusted.

If a list, e.g. a frequency/level list, is used for a list of user correction data, a reference to this list is also stored. The list is also loaded when the associated instrument setting is loaded. If the list has been deleted in the meantime (or it is not available on a different instrument), an error message appears if an attempt is made to access this list after the instrument setting has been loaded. The associated setting or operating mode, is only started after the user has selected an existing list. If the list has been overwritten in the meantime, the new entries will be used.

Note:
Lists are stored and loaded in the appropriate menus. For example, the user correction data list is created and stored in the ***User Correction*** *menu.*

When loading an instrument setting, it is possible to select whether the current frequency and level setting is to be retained or whether the stored settings are to be activated. It is possible to delete stored instrument settings.

A file can be copied by loading it with "Recall" and then storing it under a new name.

Settings can be transferred easily between instruments with different equipment options and/or firmware versions because only the settings which differ from the preset values are affected. When settings are loaded, only those which are possible on the instrument are implemented. Error messages indicate the settings which cannot be implemented. The stored file is transferred from one instrument to another using the memory stick.

General file management functions such as copying and moving data are available in the **File Manager** submenu.

Recall Menu - Setup Settings

The settings available in the File menu depend on the operation selected under **Select Operation**.

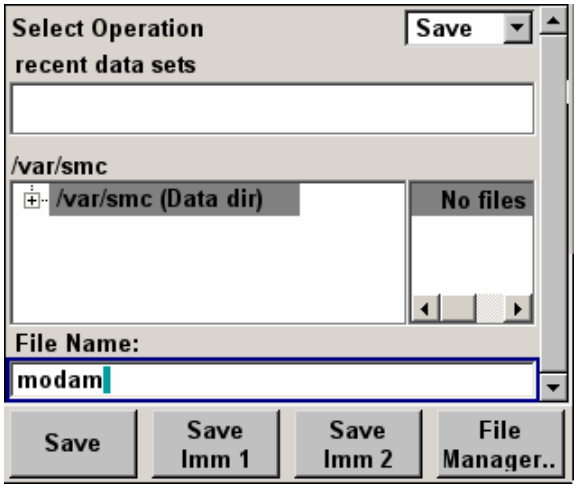
Select Operation Selects the file function.

Save… Calls the menu for storing the current instrument setting.

Recall... Calls the menu for calling up a stored instrument setting.

Save Menu - Setup Settings

If **Save** is selected under **Select Operation**, the File menu provides options for storing the current instrument setting in a file.



Recent data sets - File Displays the files last used. The entire path is shown in plain text.

Remote-control command: n.a.

Directory - File

Selects the directory in which the file is to be stored. The window opposite lists all settings files in this directory.

A new directory can be created in the File Manager (**File Manager...** button).

Remote-control command:
`MMEM:CDIR "/var/user"`
(The path can also be entered when the file is stored.)

File List - File

Displays the files which are in the selected directory.

If a file is highlighted, it is overwritten when the file is stored.

Remote-control command:
`MMEM:CAT?`

File Name - File

Enter the file name of the file without file extension. This file is then created.

Remote-control command: n.a.
(The file name is entered when the file is stored.)

Save - File

Stores the current instrument settings under the specified path.

Remote-control command:
`*SAV 1`
`MEMM:STOR:STAT 1,"/var/user/testfile.savrcl"`

Save Immediate x

Stores the current instrument setting in one of the three intermediate memories.

These instrument settings are retained until a different instrument setting is stored in the intermediate memory. When the instrument is switched off, the contents of the intermediate memories are retained.

Remote-control command:
`*SAV 1`

File Management

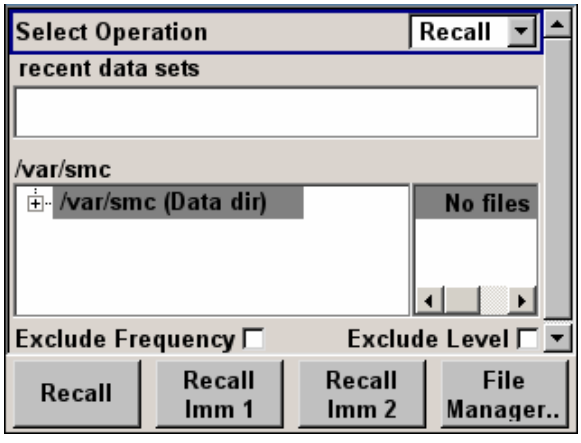
Calls the **File Management** menu.

Directories can be created and files managed in this menu (see the section "*File Management - File*", page 4.29).

Remote-control command: n.a.

Loading Instrument Settings - Setup Settings

If **Recall** is selected under **Select Operation**, the **File** menu provides options for loading complete instrument settings. Here it is possible to select whether the current or stored RF frequency and RF level settings are to be used.



Recent data sets - File

Displays the files last used. The entire path is shown.

If the desired file is in the list, it can be selected in this window.

Remote-control command: n.a.

Directory - File

Enter the directory in which the file with the instrument setting to be loaded is located.

The **Selected file** window lists all the files in this directory.

Remote-control command:
`MMEM:CDIR "/var/user"`

File List - File

Selects the file with the desired instrument configuration.

Remote-control command:
`MMEM:CAT?`

Exclude Frequency - File

The current frequency is retained when a stored instrument setting is loaded.

Remote-control command:
`SOUR:FREQ:RCL EXCL`

Exclude Level - File

The current level is retained when a stored instrument setting is loaded.

Remote-control command:
`SOUR:POW:RCL EXCL`

Recall - File

Loads the selected configuration.

If an instrument setting in which a sweep was activated is stored, the sweep is started when the recall command is called.

If an instrument setting which accesses lists is stored, this list is also loaded.

If the list has been deleted in the meantime, an error message appears when the instrument setting is loaded. If the list has been overwritten in the meantime, the new entries will be used.

Remote-control command:

```
MEMM:LOAD:STAT 2,"/var/user/testfile.savrcl"
*RCL 2
```

Recall Immediate x

Loads the selected configuration from one of the three intermediate memories.

If an instrument setting in which a sweep was activated is stored, the sweep is started when the recall command is called.

If an instrument setting which accesses lists is stored, this list is also loaded.

If the list has been deleted in the meantime, an error message appears when the instrument setting is loaded. If the list has been overwritten in the meantime, the new entries will be used.

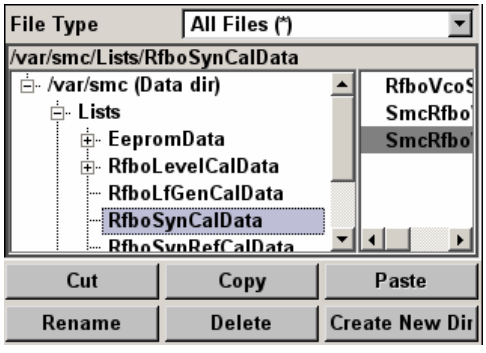
A message appears if no instrument configuration is stored in this memory.

Remote-control command:

```
*RCL 1
```

File Management - File

The **File Management** menu provides all the functions required for file management. Directories can be created, and files copied, deleted and moved between the directories on the devices (internal memory flash and memory stick).



File Type

Selects the file types to be indicated. If a file type with a specific file extension (*.lsw) is selected only files with this extension are indicated in the selected directory.

Remote-control command: `n.a.`

Directory

Selects the directory in which the file to be deleted or copied is located. The window to the right lists all files in this directory. The file to be deleted or copied can be highlighted. The path is indicated above the directory window.

Remote-control command:
`MMEM:CDIR "/var/user"`

Files

Selects the file.

Remote-control command: `n.a.`

Cut

Cuts the selected file. It can be pasted into a different directory using the **Paste** button.

Remote-control command:
`MMEM:DEL '/var/test.savercl'`

Copy

Copies the selected file. It can be pasted into a different or the same directory using the **Paste** button. When pasting the file into the same directory file name "Copy of <filename>" is given automatically. When pasting the file into a different directory, the original filename is kept.

Remote-control command:
`MMEM:COPY "/var/user/set1.wv","/var/user/set2.wv"`

Paste

Pastes the file that has been copied or cut before.

Remote-control command: `n.a.`

Rename

Renames the selected file or directory. The new name can be entered in the **New Filename** window.

Remote-control command:
`MMEM:MOVE "test02.dm_iqd","set2.dm_iqd"`

Delete

Deletes the selected file. Before the file is deleted, a message appears prompting the user to confirm deletion of the file.

Remote-control command:
`MMEM:DEL '/var/test.savercl'`

Create New Directory

Creates a new directory. The name of the new directory can be entered in the **New Directory** window.

The directory is created as a subdirectory in the selected level.

Remote-control command:
`MMEM:MDIR '/var/user/test'`

***Note**:*
When the subdirectory is entered, it is possible to enter an absolute path name (e.g. "`/var/user//meas`") or the path relative to the current directory (e.g. "`..`/`MEAS`").

Factory Preset - Setup-Setting

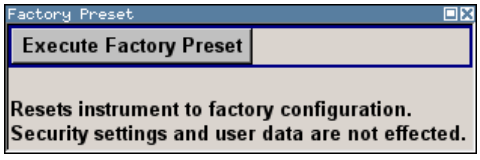
The **Factory Preset** submenu provides a function to reset the instrument's settings to their factory state. This function is activated by pressing the **Execute Factory Preset** button.

Note:
*Since **Factory Preset** resets the remote channel and network settings to the default values, executing Factory Preset via remote control terminates the connection to the instrument, if these settings had been configured to values different to the default ones!*

The **Factory Preset** function resets nearly all instrument settings. In addition to the regular preset by means of the PRESET key, a **Factory Preset** resets also the following values:

- Reference frequency settings (Ref Oscillator menu)
- Power on settings (Level/EMF menu)
- Network settings including hostname (Setup menu)
- Remote Channel settings including IEC/IEEE-bus address and emulation (Setup menu)
- Start/Stop Gui Update (Setup menu)
- Display and keyboard settings (Setup menu).

To maintain security, password settings and all settings protected by these passwords like disabled USB and LAN connections are not changed.
Not affected by the **Factory Preset** are also user data, lists or instrument settings files, created for example by means of the Save/Recall function.


Factory Preset
Execute Factory Preset
Resets instrument to factory configuration.
Security settings and user data are not effected.

Remote-control command:
`SYST:FPR`

Switching to Manual Control - Local Key

In remote control mode a status message appears in the display header. The rest of the display remains unchanged and shows the current instrument status, i.e. the status which exists under the remote control settings. The instrument can be operated (e.g. menus can be opened). However, it is not possible to enter or change values.

The status message additionally indicates whether the LOCAL key is disabled or enabled (see also Chapter 5, Chapter 5 , section *"Switch-Over to Remote Control"*).

If the **REMOTE** status message is shown, the LOCAL key switches the instrument from remote control to manual control. The current command must be fully processed before the mode is switched, otherwise the instrument switches immediately back to remote control.

If the **REM-LLO** status message (remote local lockout) is displayed, the instrument can be switched from remote control to manual control by means of remote control only (e.g. with the Visual Basic command `CALL IBLOC (generator%)`); the LOCAL key is disabled. The key is disabled by remote control with the interface message LLO.

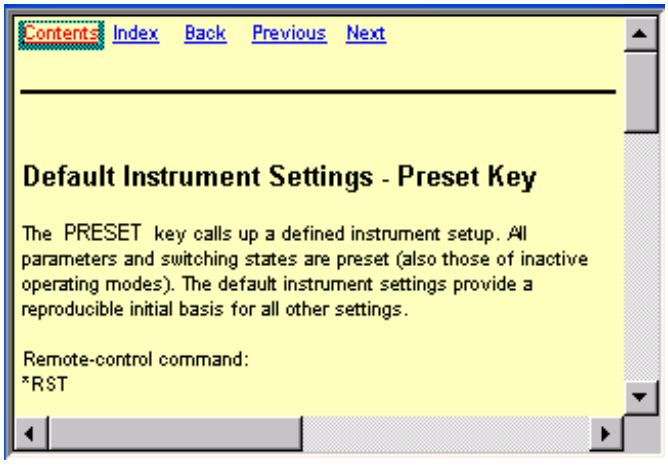
When switching from remote control to manual control, the display update suppression function, if active (SETUP- **GUI Update is O**), is automatically deactivated (SETUP- **GUI Update is On**).

Messages - Info Key

The INFO key opens a window containing a detailed description of every message displayed in the info bar, see chapter 3, section *"Info and Status Bar"* and chapter 9, section "*Error Messages"*.

Help System - Help Key

The HELP key opens a browser window containing a context-sensitive description of the highlighted parameter.


Contents
Index
Back
Previous
Next
Default Instrument Settings - Preset Key
The PRESET key calls up a defined instrument setup. All parameters and switching states are preset (also those of inactive operating modes). The default instrument settings provide a reproducible initial basis for all other settings.
Remote-control command:
*RST

The context-sensitive page which is opened with the HELP key is part of a comprehensive help system. It is possible to move from this context-sensitive page to any page of the help system. The following navigation aids are available:

- **Contents link**
  The Contents link calls up the contents list. The contents list is used to open the individual help pages. It has a hierarchical structure. The highlighted line indicates where the currently displayed page is within the contents list.

- **Index link**
  The Index link calls up the index. The index contains an alphabetical list of all terms which refer to functions of the instrument. For example, it contains all parameter names and all IEC/IEEE-bus commands. The associated help page can be opened by selecting an entry.

- **Back link**
  The Back link calls up the page last viewed.

- **Internal links in the text**
  They open pages which are directly linked to the described function. In this way it is possible, for example, to call up the description of the IEC/IEEE-bus command for any particular function.

- **Previous/Next links**
  The Previous/Next links allow scroll through the help pages. The sequence of the described functions corresponds to their position in the menus.

The links are highlighted in blue, and can be selected and called up using the rotary knob.

Note:
*The online help for the R&S SMC Signal Generator is also accessible via the **Help** menu . A desired topic can be selected via the table of contents (select **Manual**) or the index (select **Index**).*

Storing and Loading Instrument Data

The Signal Generator allows complete instrument settings to be stored on the internal flash memory or an external USB device. Defined and complex instrument settings can then be reproduced at any time by loading this data. If required, these settings can be loaded to various signal generators.

The corresponding menu is available under **Save/Recall** in the Setup menu. The instrument settings are saved in files which can be stored in a data directories.

Additionally there are intermediate memories in which the current instrument settings can be stored and called up again by just pressing a key. This provides fast switching between different instrument settings.

Only settings which differ from the preset values are stored. As a result the files remain relatively small. Furthermore, instrument settings can easily be transferred between different equipped signal generators since the files contain only relevant information. When loaded, the referenced settings are implemented and all non-referenced parameters are set to the associated preset values.

If list data is part of the instrument settings, e.g. a list of user correction data, a reference to this list is stored, not the list itself. The list is reactivated when the associated settings are loaded, but the list may have been modified or deleted in the meantime or may not be available on a different instrument. If the list has been modified, the new entries will be used. An error message appears if an attempt is made to access a non-existing list or to activate settings which are not supported by the instrument.

Note:

- Network settings and remote settings are not saved and restored.

*- Lists are stored and loaded in the appropriate menus. For example, the user correction data list is created and stored in the **User Correction** menu.*

When loading an instrument setting, it is possible to select whether the current frequency and level setting is to be retained or whether the stored settings are to be activated. It is possible to delete stored instrument settings.

General file management functions such as copying and moving data are available in the **File Manager** submenu.

File Menu

The settings available in the File menu depend on the operation selected under **Select Operation**.

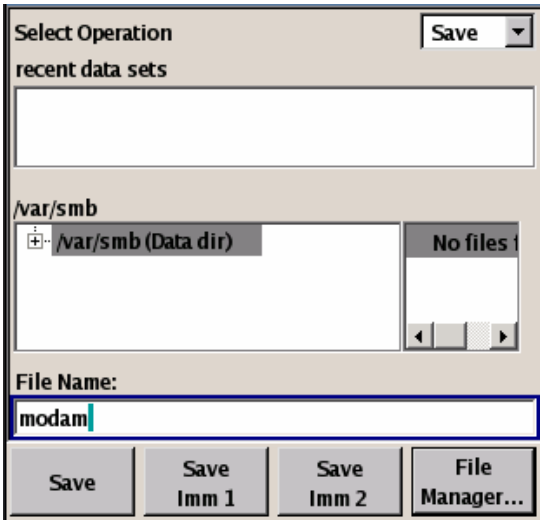
Select Operation Selects the file function.

Save… Calls the menu for storing the current instrument setting.

Recall... Calls the menu for calling up a stored instrument setting.

Storing Instrument Settings - File

If **Save** is selected under **Select Operation**, the File menu provides options for storing the current instrument setting in a file.



Recent data sets - File Displays the files last used. The entire path is shown in plain text.

Remote-control command: `n.a.`

Directory - File

Selects the directory in which the file is to be stored. The window opposite lists all settings files in this directory.

A new directory can be created in the File Manager (File Manager… button).

Remote-control command:
`MMEM:CDIR "/var/user"`

(The path can also be entered when the file is stored.)

File List - File

Displays the files which are in the selected directory.

If a file is highlighted, it is overwritten when the file is stored.

Remote-control command:
`MMEM:CAT?`

File Name - File

Enters the file name of the file without file extension. This file is then created.

Remote-control command: n.a.
(The file name is entered when the file is stored.)

Save - File

Stores the current instrument settings under the specified path.

Remote-control command:
```
*SAV 1
MEMM:STOR:STAT 1,"/var/user/testfile.savrcl"
```

Save Immediate x

Stores the current instrument setting in one of the three intermediate memories.

These instrument settings are retained until a different instrument setting is stored in the intermediate memory. When the instrument is switched off, the contents of the intermediate memories are retained.

Remote-control command:
```
*SAV 1
```

File Management

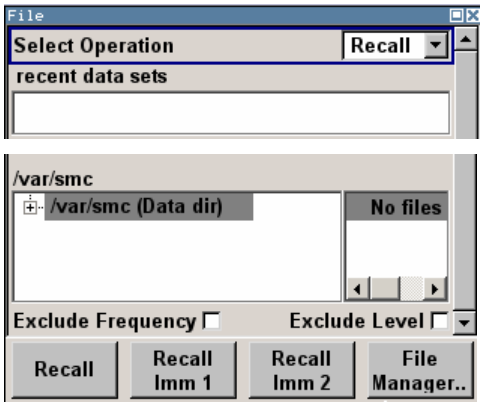
Calls the **File Management** menu.

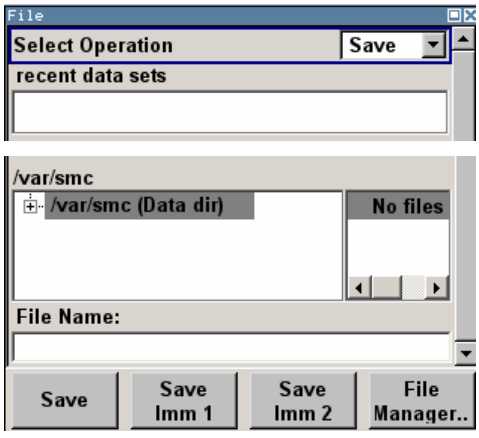
Directories can be created and files managed in this menu (see the section "*File Management - File*", page 4.29).

Remote-control command: `n.a.`

Loading Instrument Settings - File

If **Recall** is selected under **Select Operation**, the **File** menu provides options for loading complete instrument settings. Here it is possible to select whether the current or stored RF frequency and RF level settings are to be used.





Recent data sets - File

Displays the files last used. The entire path is shown.

If the desired file is in the list, it can be selected in this window.

Remote-control command: `n.a.`

Directory - File

Enter the directory in which the file with the instrument setting to be loaded is located.

The **Selected file** window lists all the files in this directory.

Remote-control command:
`MMEM:CDIR "/var/user"`

File List - File

Selects the file with the desired instrument configuration.

Remote-control command:
`MMEM:CAT?`

Exclude Frequency - File

The current frequency is retained when a stored instrument setting is loaded.

Remote-control command:
`SOUR:FREQ:RCL EXCL`

Exclude Level - File

The current level is retained when a stored instrument setting is loaded.

Remote-control command:
`SOUR:POW:RCL EXCL`

Recall - File

Loads the selected configuration.

If an instrument setting in which a sweep was activated is stored, the sweep is started when the recall command is called.

If an instrument setting which accesses lists is stored, this list is also loaded. If the list has been modified, the new entries will be used. An error message appears if an attempt is made to access a non-existing list or to activate settings which are not supported by the instrument.

Remote-control command:
MEMM:LOAD:STAT 2,"/var/user/testfile.savrcl"
`*RCL 2`

Recall Immediate x

Loads the selected configuration from one of the three intermediate memories.

If an instrument setting in which a sweep was activated is stored, the sweep is started when the recall command is called.

If an instrument setting which accesses lists is stored, this list is also loaded.

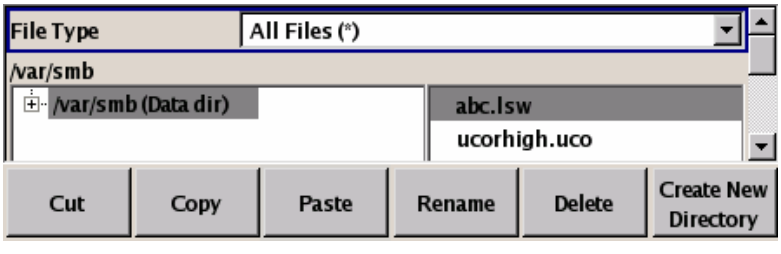
If the list has been deleted in the meantime, an error message appears when the instrument setting is loaded. If the list has been overwritten in the meantime, the new entries will be used.

A message appears if no instrument configuration is stored in this memory.

Remote-control command:
*RCL 1

File Management - File

The **File Management** menu provides all the functions required for file management. Directories can be created, and files copied, deleted and moved between the directories on the devices (internal flash memory and memory stick).



File Type

Selects the file types to be indicated. If a file type with a specific file extension (*.lsw) is selected only files with this extension are indicated in the selected directory.

Remote-control command: `n.a.`

Directory

Selects the directory in which the file to be deleted or copied is located. The window to the right lists all files in this directory. The file to be deleted or copied can be highlighted. The path is indicated above the directory window.

Remote-control command:
`MMEM:CDIR "/var/user"`

Files

Selects the file.

Remote-control command: `n.a.`

Cut

Cuts the selected file. It can be pasted into a different directory using the **Paste** button.

Remote-control command:
`MMEM:DEL '/var/test.savercl'`

Copy

Copies the selected file. It can be pasted into a different or the same directory using the **Paste** button. When pasting the file into the same directory file name "Copy of <filename>" is given automatically. When pasting the file into a different directory, the original filename is kept.

Remote-control command:
`MMEM:COPY "/var/user/set1.wv","/var/user/set2.wv"`

Paste

Pastes the file that has been copied or cut before.

Remote-control command: `n.a.`

Rename

Renames the selected file or directory. The new name can be entered in the **New Filename** window.

Remote-control command:
`MMEM:MOVE "test02.dm_iqd","set2.dm_iqd"`

Delete

Deletes the selected file. Before the file is deleted, a message appears prompting the user to confirm deletion of the file.

Remote-control command:
`MMEM:DEL '/var/test.savercl'`

Create New Directory

Creates a new directory. The name of the new directory can be entered in the **New Directory** window.

The directory is created as a subdirectory in the selected level.

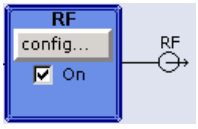
Remote-control command:
`MMEM:MDIR '/var/user/test'`

***Note**:*
When the subdirectory is entered, it is possible to enter an absolute path name (e.g. "/var/user//meas") or the path relative to the current directory (e.g. ". ./MEAS").

RF Signal - RF

Overview of RF Signal

Settings for the RF output signal are made under "RF Signal". These settings can be accessed in the block diagram by way of the **RF** function block, or by means of the menu with the same name which is opened using the SETUP key.



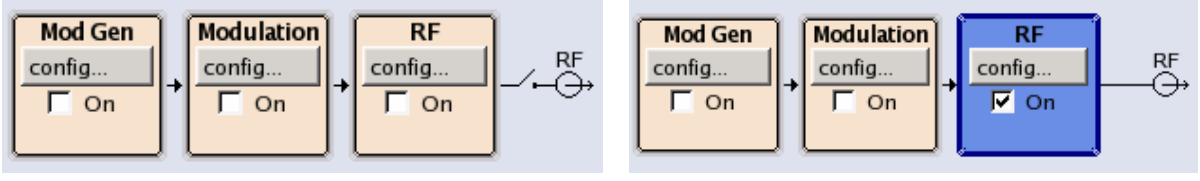
The function block is available for the basic unit (R&S SMC + frequency option R&S SMC-B10x) without additional equipment options.

The RF ON/OFF key can be used to activate and deactivate the output signal irrespective of the current entry focus. The previous state is restored when the signals are reactivated.

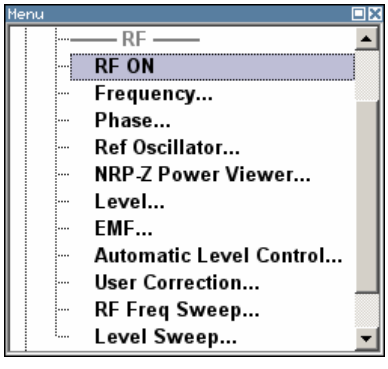
Remote-control command:

```
OUTP:STAT OFF
OUTP:STAT ON
```

The activated and deactivated state is indicated in the block diagram by means of the different block color and the status of the **On** checkbox. The disconnected connection to the output is additionally shown when the output is deactivated. An active sweep is also indicated in the block.



The RF output state can also be set in the **Configure** menu of the RF block:



The CW and Sweep modes are available for generating the RF signal.

CW	The RF signal is generated with the set frequency and level. This is the default mode.
Sweep	The RF signal is generated as a sweep with the set parameters.

Instruments connected downstream can be taken into consideration when setting the frequency and level by entering a frequency and/or level offset.

Automatic level control ensures maximum level accuracy.

User-specific lists which contain level correction values for any frequency range (User Correction) can be created to, for example, compensate the cable attenuation in a test assembly setup.

The RF signal can be also generated in modulated form. An internal LF generator, internal pulse generator and/or the external modulation inputs **MOD EXT** at the front and **PULSE EXT** at the back of the instrument are available as the source for the analog modulations.

An external trigger signal for the sweeps can be provided at the **INST TRIG** input. The input **REF IN** is used to input an external instrument reference frequency, and the output **REF OUT** serves as the output of the reference frequency (internal or external).

RF Frequency

The easiest way to set the RF frequency is to enter it directly in the header of the display.

The entry is activated by pressing the FREQ key. Changes to the frequency have an immediate effect (without confirmation with the Enter key) on the output signal.

Remote-control command
`SOUR:FREQ 100 MHz`

Note:
*The IEC/IEEE-bus command sets the level of the **Freq** display, i.e. an entered frequency offset is taken into consideration in the frequency value (see below).*

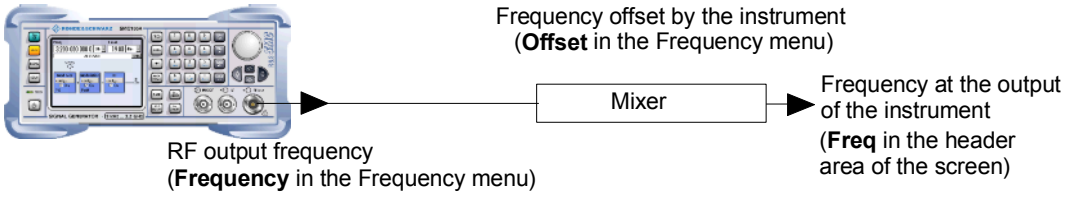
The frequency entered and displayed in the frequency entry field takes any set frequency offset into consideration, e.g. an offset set for a downstream instrument. This means that with a frequency offset the frequency displayed in the header does not correspond to the frequency at the RF output, but rather to the frequency at the output of the downstream instrument. A set frequency offset is indicated by the **FREQ OFFSET** status message.

This allows the desired frequency at the output of a downstream instrument to be entered in the frequency field. The R&S SMC Signal Generator changes the RF output frequency according to the entered offset.

However, the frequency entered and displayed in the **Frequency** menu of the **RF** function block always corresponds to the RF output frequency. Any frequency offset is not taken into consideration.

The correlation is as follows:

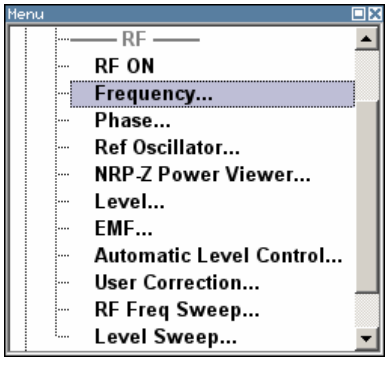
Freq in header = RF output frequency (= Freq in menu) + Freq offset (= Offset in menu)



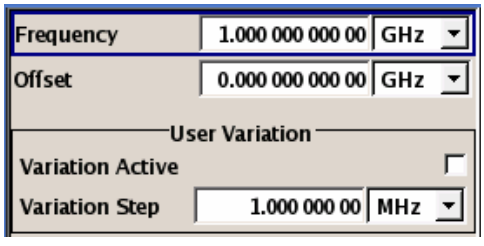
The frequency offset is entered in the **Frequency** menu. Here it is also possible to set the frequency without taking the offset into consideration, to set the step width for the frequency entry using the rotary knob, and to set the phase for the RF output signal.

Frequency - Menu

The **Frequency** menu is opened in the **RF** function block or using the SETUP key under **RF**.



Frequency and offset of the RF output signal is set in the upper part of the group menu. The step width which is used when setting the frequency using the rotary knob (with **Variation Active On**) is set in the **User Variation** section.



The lower parts concern the phase settings for the output signal and are described in the section "*RF Phase*", page 4.42.

The frequency and offset are set in the top section of the menu.

Frequency - RF Signal

Sets the RF frequency of the RF output connector. The frequency entered and displayed here corresponds to the frequency at the RF output, i.e. any offset entry is not taken into consideration.

Remote-control command: `n.a.`

Note:
*There is no GPIB command available for this setting. The GPIB command `SOUR:FREQ` sets the frequency of the **FREQ** display, i.e. the frequency containing offset.*

Frequency Offset - RF Signal

Sets the frequency offset relative to the RF frequency. The frequency offset of a downstream instrument (e.g. a mixer) is entered.

The entry does not change the RF frequency at the RF output. It only changes the RF frequency displayed in the display header. the RF frequency in the header corresponds to the frequency.

Remote-control command:
`SOUR:FREQ:OFFS 0 Hz`

If the frequency is set using the rotary knob, the step width is defined in the **User Variation** section.

Variation Step - RF Signal

Sets the user-defined step width. This step width is used when entering the RF frequency using the rotary knob. Frequency variation with this step width must also be activated with **Variation Active**.

Remote-control command:
`SOUR:FREQ:STEP 1 MHz`

Variation Active

Activates the user-defined step width used when varying the frequency value with the rotary knob.

ON

The frequency value set with the rotary knob is varied using the user-defined step width which is entered under **Variation Step**.

Remote-control command:
`SOUR:FREQ:STEP:MODE USER`

OFF

The frequency value set with the rotary knob is varied in steps of one unit at the cursor position (standard operating mode).

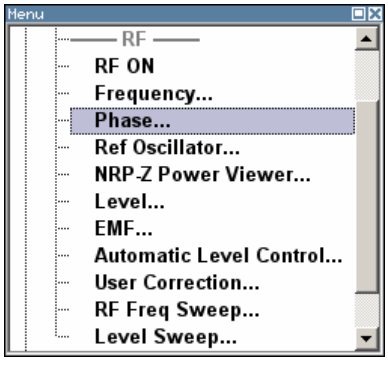
Remote-control command:
`SOUR:FREQ:STEP:MODE DEC`

RF Phase

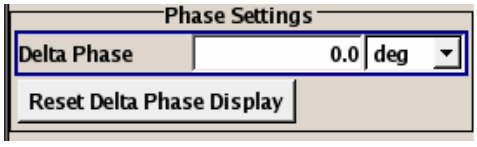
The phase of the RF output signal can be changed in the **RF Phase** menu.

Phase - Menu

The **Phase** menu is opened in the **RF** function block or using the SETUP key under **RF**.



The phase of the output signal can be changed in the **Phase Settings** section (upper part of the group menu).



The upper parts concern the frequency settings for the output signal and are described in the section "*RF Frequency*", page 4.40

Delta Phase – RF Phase

Sets the phase of the RF signal. The current phase of the signal is used as the reference. This function allows, for example, the phase of the output signal to be synchronized with the phase of a signal from a second signal generator.

Remote-control command:
`SOUR:PHAS 10 DEG`

Reset Delta Phase Display – RF Phase

Resets delta phase value. The set phase is adopted as the new current phase, i.e. the delta phase value is reset to 0.

Remote-control command:
`SOUR:PHAS:REF`

RF Reference Frequency - Reference Oscillator

In the internal reference mode the internal reference signal is available at the **REF OUT** connector (rear of instrument). The frequency of the internal reference signal is fixed to 10 MHz.

External impairment is possible in both **Adjustment State** states (**On** or **Off**).

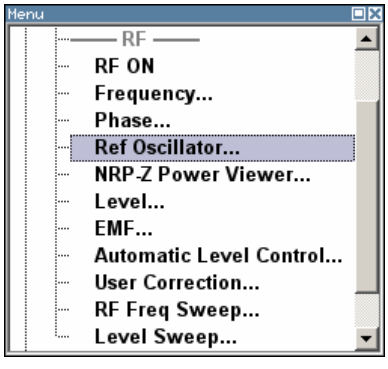
For **EFC (Electronic Frequency Control)**, e.g. in phase noise measurement systems, external FM modulation (DC coupling) in low noise mode is used. FM-DC mode yields a fixed tuning sensitivity which is independent from the set RF output frequency. The tuning sensitivity is equal to the set FM deviation.

In the external reference mode an external signal with selectable frequency and defined level must be input at the **REF IN** connector . This signal is output at the **REF OUT** connector. The **EXT REF** status message appears in the display header.

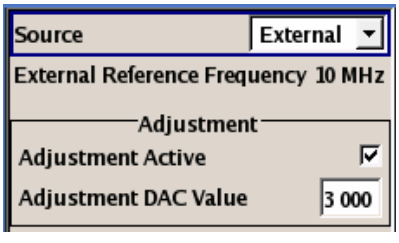
Note:
The setting of the reference oscillator are not influenced by an instrument preset (PRESET key).

Reference Oscillator Menu

The **Reference Oscillator** menu is opened in the **RF** function block or using the SETUP key under **RF**.



The menu is used to select the source, to enter the frequency of an external reference signal and to adjust the reference frequency. The external mode corresponds to EFC mode (Electronic Frequency Control)".



Source - Reference Oscillator

Selects the source of the reference frequency.

Internal — The internal reference signal of 10 MHz is used.

Remote-control command:
`SOUR:ROSC:SOUR INT`

External — An external reference signal is used. The frequency of the external reference signal must be selected under **External Reference Frequency**.

Remote-control command:
`SOUR:ROSC:SOUR EXT`

External Reference Frequency - Reference Oscillator

Selects the frequency of the external reference signal.

Remote-control command:
`SOUR:ROSC:EXT:FREQ 13E6`

Adjustment Active - Reference Oscillator

Source internal only

Activates the adjustment mode.

OFF — The calibrated adjustment value of the internal reference frequency is used. This value is determined at one of the R&S service shops during calibration.

Remote-control command:
`SOUR:ROSC:INT:ADJ:STAT OFF`

On — A user-defined adjustment value is used. The value is entered under **Adjustment DAC Value**.

This allows the frequency to be impaired freely, for example to simulate a frequency error.

The instrument is no longer in the calibrated state. However, the calibration value is not changed and the instrument resumes the calibrated state after switching the Adjustment state to OFF.

Remote-control command:
`SOUR:ROSC:INT:ADJ:STAT ON`

Adjustment DAC value - Reference Oscillator

Enters a user-defined adjustment value for the internal reference frequency. This value is not used unless **Adjustment Active On** is selected.

Remote-control command:
`SOUR:ROSC:INT:ADJ:VAL 1400`

Power Viewer

R&S NRP power sensors can be connected via the USB interfaces (front and rear panel, requires USB adapter R&S NRP-Z3 or R&S NRP-Z4). The connected R&S NRP power sensor is automatically detected and indicated in the **NRP-Z Power Viewer** menu.

The average signal power is continuously measured by the R&S NRP power sensor and indicated in the Power Sensors menu (**NRP-Z Power Viewer**). Permanent display of the measurement results in the block diagram can be activated.

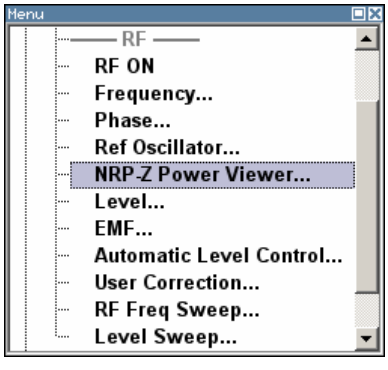
The output signals of the RF signal path (reference level is the set RF level) or any freely selectable source can be measured.

The signal generator supports the use of R&S NRP power sensors for the acquisition of level correction data. The acquired level correction data is used to create and activate lists in which level correction values predefined by the user are freely assigned to RF frequencies. Correction is performed by the user-defined table values being added to the output level for the respective RF frequency (see *User Correction*, on page *4.59*).

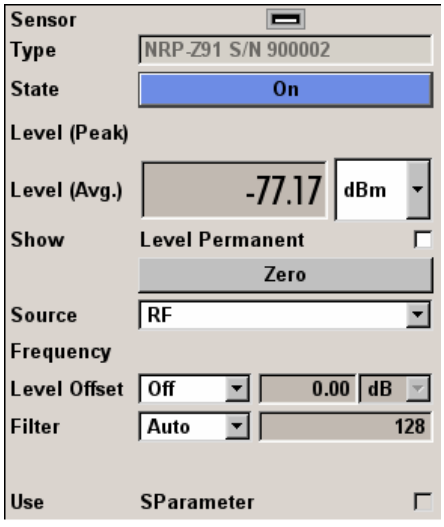
Note:
Please see your R&S NRP power sensor manual for detailed information on the used power sensor.

NRP-Z Power Viewer Menu

The **Power Sensor** menu is opened either in th **RF** function block or using the SETUP key **RF**.



The menu shows the power sensor type, the measurement value and allows to configure the measurement.



Sensor - Power Sensors

Indicates the USB connector used for the detected sensors.

Remote-control command:
`SENS:STAT?`
Response. 0 (no power sensor is connected)
Response. 1 (a power sensor is connected at the USB connector)

Note:
The software version of the connected power sensor can be retrieved by means of the remote control command:
`SENS:POW:SVER?`

Type - Power Sensors

Indicates the type of the connected R&S NRP power sensor. The sensor type is automatically detected.

Remote-control command:
`SENS:POW:TYPE?`

State - Power Sensors

Activates/deactivates level measurement by the power sensor.

Remote-control command:
`INIT:POW:CONT OFF|ON`

The local state is set with the INIT command. Switching the local state off enhances the measurement performance.

In remote control, the sensors are set up using the SENSe commands. The remote measurement is triggered by the READ query which also provides the measurement results. The state is not influenced by these commands, measurements results can be retrieved with local State on or off.

```
SENS:POW:FILT:TYPE USER
SENS:POW:FILT:LENG:USER 16
READ:POW?
```

Level - Power Sensors

Indicates the measured level value with the selected unit.

Remote-control command:
`READ:POW?`

Unit - Power Sensors

Selects the unit used for result display.

The power sensor provides the measured value in Watt.

In which unit the measured value is indicated is selected here and might be Watt, dBm or dBuV.

Remote-control command:
`SENS:UNIT:POW DBM`

Show Level Permanent - Power Sensors

Activates the permanent indication of the power measurement result in the upper right corner of the block diagram. For each sensor, the type of sensor, the connector, the measurement source and - if set - the offset is indicated.

Remote-control command:
`SENS:POW:DISP:PERM:STAT ON`

Zero - Power Sensors

Activates the auto zero function.

Zeroing calibrates the external power sensor by adjusting its reading at zero signal power. For this purpose, the RF power source must be switched off or disconnected from the sensor (see tips below). R&S power sensors automatically detect the presence of any significant input power. This aborts zeroing and generates an error message. Zeroing can take a few seconds, depending on the sensor model; refer tothe documentation of your external power sensor for more information.

Tips for zeroing

Perform zeroing

- During warm-up after switching on or connecting the instrument
- After a substantial change of the ambient temperature
- After fastening the power sensor module to an RF connector at high temperature
- After several hours of operation
- When very low-power signals are to be measured, e.g. less than 10 dB above the lower measurement limit.

Switch off the RF power source for zeroing; do not disconnect it from the power sensor. In this way you will maintain the thermal equilibrium, and zeroing will also compensate for the noise superimposed on the measured signal (e.g. from a broadband amplifier).

Remote-control command:
`SENS:POW:ZERO`

Source - Power Sensors

Selects the source for measurement frequency of the sensor.

RF

Measurement source is the RF signal of the generator. The RF frequency is used as the measurement frequency of the sensor and the corresponding correction factor is used.

In this mode the RF frequency of the generator is send to the sensor automatically if changed.

Remote-control command:
`SENS:POW:SOUR A`

User

Measurement source is any freely selectable source. The frequency is entered manually under frequency.

Remote-control command:
`SENS:POW:SOUR USER`

Frequency - Power Sensors

Source User only

Enters the frequency for measurement source **User**.

Remote-control command:
`SENS:POW:FREQ 2.5MHz`

Level Offset - Power Sensors

Activates and defines a level offset which is added to the measured value. This allows e.g. an attenuator in the signal path to be taken into account. The offset is always entered in dB, irrespective of the selected unit for result display.

Remote-control command:
`SENS:POW:OFFS -2 dB`
`SENS:POW:OFFS:STAT ON`

Filter Length - Power Sensors

Selects the filter length used for measurement.

The averaging filter is used to reduce fluctuations in the measured result to the extent desired. Such fluctuations can be caused by inherent noise of the measuring instrument, modulation of the measurement signal or beats from the superposition of adjacent carriers. A more stable display has to be traded off against longer measurements. The measurement result is obtained from a two-stage averaging process.

Note:
Longer measurements does not mean that it takes longer to display a new result, but rather that it takes longer for the result to settle when the power changes.

Measurements are continuously repeated in a predefined time window. The measurement result is obtained by averaging the measured values for the last 2N time windows. The number N is the filter length, the factor of 2 arises because the output signals from the microwave detector to suppress low-frequency noise are chopped at the same rate as the time windows, which means that an independent measured value can only be obtained from two consecutive values. As the filter length is the multiplier for the time window it directly influences the measurement time.

The filter length can be selected automatically or can be manually set to a fixed value. As a preliminary, you should always check if the auto mode is giving satisfactory results because you will always have to adjust an optimal, manual filter-length setting if the power is not constant.

Selection **Fixed Noise** is offered for reaching a defined measurement accuracy.

Auto

The filter length is automatically selected and adapted to the currently measured value. With very high signals the filter length and therefore the measurement time can be short. With very low signal levels the filter length and therefore the measurement time is increased in order to reduce noise. The used filter length is indicated in the field to the right.

Remote-control command:
```
SENS:POW:FILT:TYPE AUTO
SENS:POW:FILT:LENG:AUTO?
```

User

The filter length is set manually.

The filter length is entered in the entry window to the right. As the filter length works as a multiplier for the time window, this results in a constant measurement time. Values 1 and 2^n are settable.

Note:
The time window varies in manual control, it is fixed to 20 ms in remote control.

The **Auto Once** button can be used to search for the optimum filter length for the current measurement conditions. The found filter length is indicated in the field to the right.

Remote-control command:
```
SENS:POW:FILT:TYPE USER
SENS:POW:FILT:SONC
or
SENS:POW:FILT:LENG:USER 16
```

Fixed Noise

The averaging factor is selected so that the sensor's intrinsic noise (2 standard deviations) does not exceed the specified noise content.

The desired noise content is entered in the entry field to the right.

To avoid very long settling times when the power is low, the averaging factor can be limited with the **Timeout** parameter.

Remote-control command:
```
SENS:POW:FILT:TYPE NSR
SENS:POW:FILT:NSR 0.001
SENS:POW:FILT:NSR:MTIM 4
```

Use SParameter - Power Sensors

Activates the use of the s-parameters correction data of the connected power sensor. For sensor with attenuator this checkbox is automatically checked.

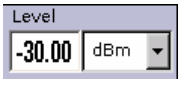
Please see the manual of the connected R&S NRP power sensor for a description on how to use the s-parameters table.

Remote-control command:
```
SENS:POW:CORR:SPD:STAT ON
```

RF Level

Note:
*The message **Level overrange/underrange** appears in the info line if the set level (**Level**) is in the overrange or underrange (see data sheet). The correct level setting cannot be guaranteed for the entire frequency range if the set level is in the overrange/underrange.*

The easiest way to set the RF level is to enter it directly in the header of the display.



The entry is activated by pressing the LEVEL key. Changes to the level have an immediate effect (without confirmation with the Enter key) on the output signal.

Remote-control command:
`SOUR:POW:LEV:IMM:AMPL  -30 dBm`

Note:
*The GPIB command sets the level of the **Level** display, i.e. an entered level offset is taken into consideration in the level value (see below).*

dBm, dBµV, mV and µV can be used as the level units. The 4 unit keys are labeled with these units.

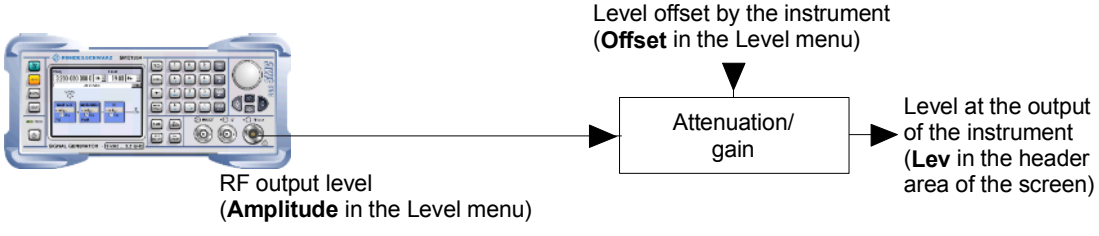
The level entered and displayed in the **Level** field takes the offset of any downstream attenuators/amplifiers into consideration by way of calculation. This means that with a level offset the level displayed in the header does not correspond to the level at the RF output, but rather to the level at the output of the downstream instrument.

This allows the desired level at the output of downstream instruments to be entered. The R&S SMC Signal Generator changes the RF output level according to the set offset.

However, the level entered and displayed in the **Level** menu of the **RF** function block always corresponds to the RF output level. Any level offset is not taken into consideration.

The correlation is as follows:

Level in header = RF output level (= Level in menu) + Level offset

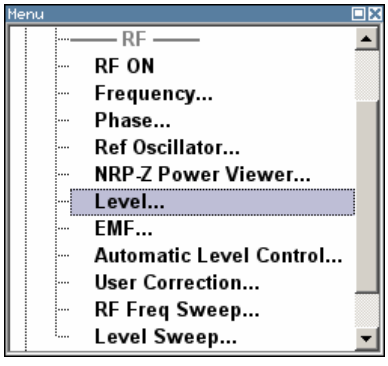


The level offset is entered in the **Level** menu. Here it is also possible to set the level without taking the offset into consideration, and to make other settings, such as level offset, attenuator mode, power-on state.

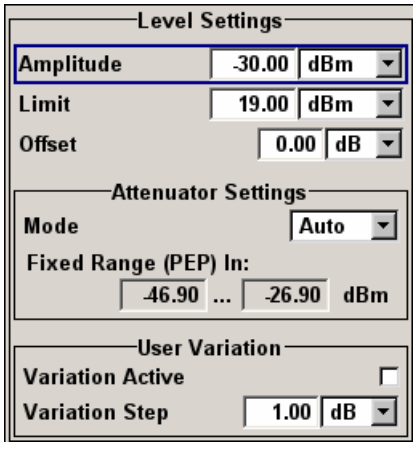
The RF output is protected against overloading by an external signal applied to the RF output (see section "*Overvoltage Protection*").

Level - Menu

The **Level** menu is opened in the **RF** function block or using the SETUP key under **RF**.



The offset-free level, level offset and level limit are set in the top section of the menu. The attenuator mode is set in the **Attenuator Settings** section .The step width which is used when setting the level using the rotary knob (with **Variation Active On**) is set in the **User Variation** section.



The offset-free level, attenuation mode, level offset and level limit are set in the top section of the menu.

Amplitude - RF Level

Sets the RF level of the RF output connector.

The level entered and displayed here corresponds to the level at the RF output, i.e. any offset entry is not taken into consideration.

Remote-control command: `n.a.`

Note:
There is no GPIB command available for this setting. The GPIB command `SOUR:POW:LEV:IMM:AMPL` *sets the level of the* ***Level*** *display, i.e. the level containing offset.*

Limit - RF Level

Sets the level limit.

The value specifies the upper limit of the level at the RF output connector. A message appears if an attempt is made to set a level above this limit and the level at the RF output is confined to the upper limit. However, the level indication is not influenced.

Remote-control command:
`SOUR:POW:LIM:AMPL 30 dBm`

Level Offset - RF Level

Sets the level offset relative to the RF level.

The level offset of a downstream instrument (e.g. an attenuator or amplifier) is entered.

The entry does not change the RF level at the RF output. It only changes the RF level displayed in the display header. the RF level in the header corresponds to the level at the output of the downstream instrument.

Remote-control command:
`SOUR:POW:LEV:IMM:OFFS 0`

The attenuator mode is set in the **Attenuator Settings** section.

Attenuator Mode - RF Level

Sets the attenuator mode at the RF output.

Auto

Standard mode. The attenuator is switched automatically. The level settings are made in the full range.

Remote-control command:
`OUTP:AMOD AUTO`

Fixed

The level settings are made without switching the attenuator. When this operating mode is switched on, the attenuator is fixed in its current position and the resulting variation range is defined. The range is displayed under **Attenuator Fixed Range**.

If automatic level control is activated (**ALC State = On**), the level settings are made without interruption.

If the normal variation range is overranged or underranged, level errors increase considerably and the warning **Level under/overrange** appears in the info line. The spectral purity of the output signal decreases with high attenuation.

Remote-control command:
`OUTP:AMOD FIX`

Attenuator Fixed Range In – RF Level

Displays the level range in which the level is set without interruption for the "**Attenuator Mode fixed**" setting.

Remote-control commands:
```
OUTP:AFIX:RANG:UPP?
OUTP:AFIX:RANG:LOW?
```

If the level is set using the rotary knob, the step width is defined in the **User Variation** section.

Variation Step - RF Level

Sets the user-defined step width for entering the RF level using the rotary knob. Level variation with this step width must also be activated with **Variation Active**.

Remote-control command:
```
SOUR:POW:STEP:INCR  1dBm
```

Variation Active - RF Level

Activates the user-defined step width used when varying the level value with the rotary knob.

ON — The level value set with the rotary knob is varied using the user-defined step width which is entered under **Variation Step**.

Remote-control command:
```
SOUR:POW:STEP:MODE USER
```

OFF — The level value set with the rotary knob is varied in steps of one unit at the cursor position (standard operating mode).

Remote-control command:
```
SOUR:POW:STEP:MODE DEC
```

Overvoltage Protection

The overvoltage protection prevent overloading by an external signal applied to the RF output of the R&S SMC Signal Generator.

The overload protection is tripped when the power of the external signal becomes too high. A relay opens and interrupts the connection between the RF output and attenuator. This condition is indicated in the display header by the 'OVERLOAD' status message.

Reset the overload protection by pressing the RF ON/OFF key. The RF input is activated when the overload protection is reset.

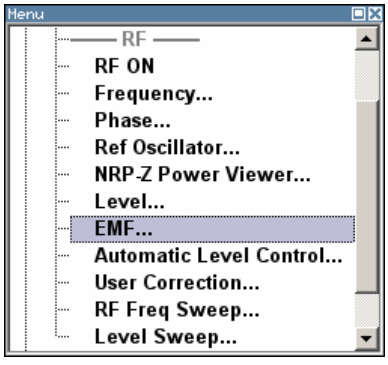
Remote-control commands:
```
OUTP:PROT:TRIP?
OUTP:PROT:CLE
OUTP:STAT ON
```

RF EMF

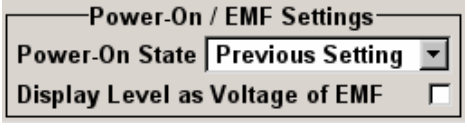
The power-on behavior of the R&S SMC Signal Generator and the level display in the display header are set in the **RF EMF** menu.

EMF - Menu

The **EMF** menu is opened in the **RF** function block or using the SETUP key under **RF**.



The power-on behavior of the R&S SMC Signal Generator and the level display in the display header are set in the **Power-On / EMF Settings** section.



Power-On State - RF Output

Selects the state which the RF output is to assume after the instrument is switched on.

RF OFF
The output is deactivated when the instrument is switched on.

Remote-control command:
`OUTP:PON OFF`

Previous Setting
When the instrument is switched on, the output assumes the same state as it had when the instrument was switched off.

Remote-control command:
`OUTP:PON ON`

Display Level as Voltage of EMF - RF Level

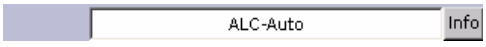
Activates display of the signal level as voltage of the EMF (no-load voltage). If this setting is deactivated, the level is displayed as a voltage with 50 Ohm (presetting).

Remote-control command: `n.a.`

Automatic Level Control - ALC

Automatic level control (**A**utomatic **L**evel **C**ontrol) can be used with almost all applications, except for pulse modulation.

The level control status is permanently displayed as a status message in the info line.



The preset status is **Auto**. In this mode the level control is automatically adapted to the operating conditions.The standard operating mode is with active level control. This provides the highest level accuracy.

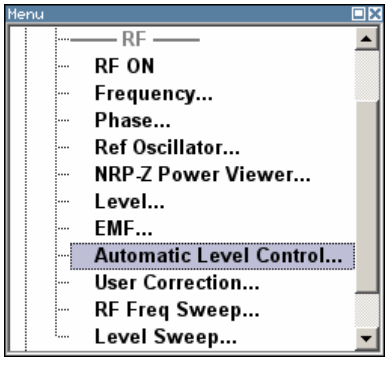
Level control can be forced to **Sample&Hold** or **On** for particular applications.

If **Sample&Hold** is selected, the level is recalibrated for every level and frequency setting. For this purpose, level control is activated briefly at a defined signal, the level adjuster is then held at the attained value and level control is deactivated.

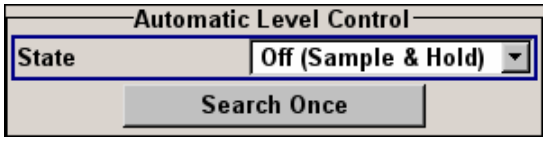
Note:
*The level is decreased by 30 dB during **Sample&Hold** measurement!*
*When pulse modulation is activated, the ALC state of the R&S SMC is automatically changed to ALC OFF (Sample & Hold). In this state the ALC loop is opened and the output level is not regulated but the level modulator is set directly. In order to set the correct output level, a sample & hold measurement is executed after each frequency or level setting. The level is decreased by 30 dB during **Sample&Hold** measurement.*

Automatic Level Control Menu

The **Auto Level Control** menu is opened in the **RF Mod** function block or in the setup menu under **RF**.



The combined **ALC / UCOR** menu provides access to the automatic level control settings in the **Auto Level Control…** section.



The lower sections provide access to the function **User Correction**, see section "*User Correction*", page 4.59.

State - ALC

Activates/deactivates internal level control.

Off
Sample&Hold

Internal level control is deactivated.

Remote-control command:
`SOUR:POW:ALC OFF`
`SOUR:POW:ALC:OMOD SHOL`

Auto

Default state. Level control is automatically adapted to the operating states.

Remote-control command:
`SOUR:POW:ALC AUTO`

On

Internal level control is permanently activated.

Remote-control command:
`SOUR:POW:ALC ON`

Note:
*The level is decreased by 30 dB during **Sample&Hold** measurement!*
*When pulse modulation is activated, the ALC state of the R&S SMC is automatically changed to ALC OFF (Sample & Hold). In this state the ALC loop is opened and the output level is not regulated but the level modulator is set directly. In order to set the correct output level, a sample & hold measurement is executed after each frequency or level setting. The level is decreased by 30 dB during **Sample&Hold** measurement.*

Search Once - ALC

Manually activates level control briefly to allow the level to be calibrated (the **Sample&Hold** setting must be selected).

Remote-control command:
`SOUR:POW:ALC:SONC`

User Correction

The "User Correction" function is used to create and activate lists in which level correction values predefined by the user are freely assigned to RF frequencies. Correction is performed by the user-defined table values being added to the output level for the respective RF frequency.

With frequencies which are not contained in the list, the level correction is determined by interpolation of the closest correction values.

The lists are created in the List Editor. Each list is stored in its own file with the predefined file extension ***. uco**. The name of the User Correction file can be freely selected. The files are loaded from the **Lists...** file manager. Externally created tables with pairs of frequency and level values can be converted into User Correction files using the import function. The external files must have the file extension *.txt or *.csv. These file formats are provided e.g. by the Microsoft Excel program. The separators for table columns and for decimal floating-point numerals can be set. In addition, internally created User Correction data can be exported into ASCII files using the export function.

The amplitude can also be linearized automatically by means of a R&S NRP power sensor connected to the generator output signal. With the aid of the **Fill with Sensor** function, a table with correction values for external test assemblies can be automatically determined, e.g. for compensating the frequency response of cables. The User Correction list with the correction values acquired by the sensor is generated in the **Edit User Correction List** menu. The correction values can be acquired any time irrespective of the modulation settings of the generator.

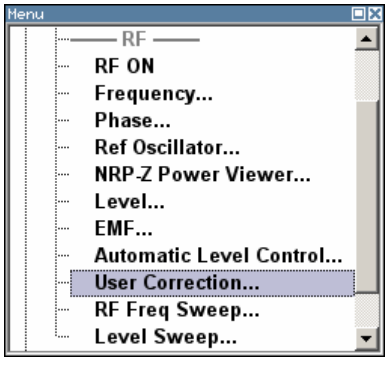
If user correction is activated, the **UCOR** display (User Correction) is shown in the header together with the **Level** display. The RF output level is the sum of both values.

Level + UCOR = Output level

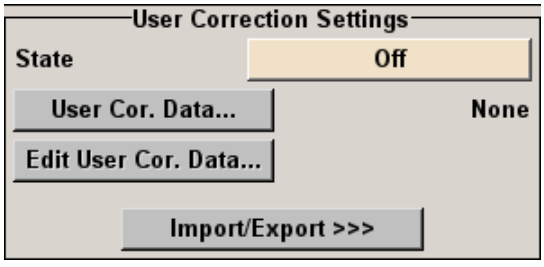
If activated, user correction is effective in all operating modes.

User Correction Menu

The **User Correction** menu is opened either in the **RF** function block or using the SETUP key under **RF**.



The combined menu ALC / UCOR menu provides access to function User Correction in the **User Correction Settings** section. The menu is used to activate/deactivate user correction, and to create, select and activate the correction data lists.



The upper sections provide access to the automatic level control settings, see section "*Automatic Level Control - ALC*", page 4.57 .

State - User Correction

Activates/deactivates user correction.

The **UCOR** status message appears in the frequency and level display.

Remote-control command:

```
SOUR:CORR:STAT ON
```

Value - User Correction

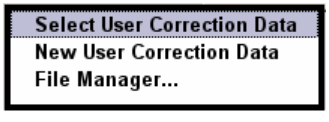
Indicates the current value for level correction.

Remote-control command:

```
SOUR:CORR:VAL?
```

User Correction Data - User Correction

Calls the **File Select** menu for selecting and creating a list or the **File Manager**.



Remote-control command:

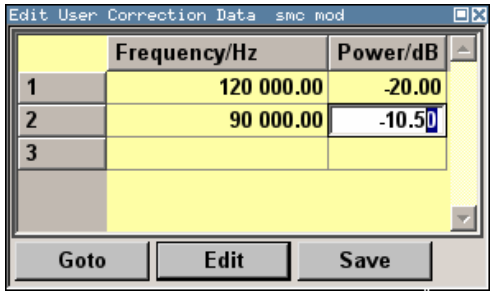
```
MMEM:CDIR '/var/ucor'
SOUR:CORR:CSET:CAT?
Response:
'Ucor1', 'Ucor2'

SOUR:CORR:CSET:SEL 'Ucor1'
SOUR:CORR:CSET:DEL 'Ucor2'
```

Edit/New User Correction Data - User Correction

Calls the editor for editing the selected user correction list. A list consists of any number of frequency/level value pairs. The currently selected list is displayed.

Each list is saved to the R&S SMC Signal Generator as a separate file with the file prefix ***.uco**. The file name and the directory to which the file is saved are user-selectable.

Note:
Save a list only after filling both columns (frequency and level), otherwise the entries are lost.



Frequency /Hz

Enters the frequency to which the level correction value applies.

Note:
*The **Fill..** function allows to automatically enter any number of frequencies with freeley selectable range and increment.*
*Using the **Fill With Sensor** function of the **Edit** sub menu requires only the entry of the frequency values. The level values are automatically acquired by the connected power sensor.*

Remote-control command:
```
SOUR:CORR:CSET:SEL 'Ucor1'
SOUR:CORR:CSET:DATA:FREQ 100MHz,...
```

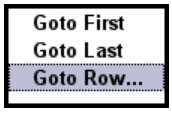
Power /dB

Enters the level correction value to which the specified frequency applies. The values can be entered manually or automatically with the **Fill With Sensor** function.

Remote-control command:
```
SOUR:CORR:CSET:SEL 'Ucor1'
SOUR:CORR:CSET:DATA:POW 1dB,0.8dB,...
```

Goto

Selects the row for editing.

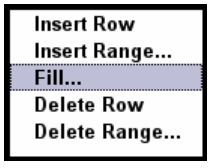


If **Goto Row**... is selected, a window opens for entering the requested row.

Remote-control command: n.a.
(it is not possible to change individual positions of the list)

Edit

Calls a selection of possible actions described below.



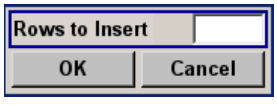
Insert Row

Inserts a new row before the marked row.

Remote-control command: n.a.

Insert Range

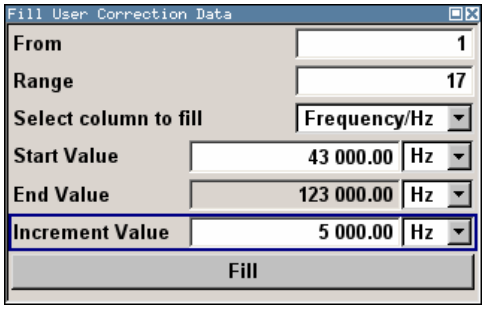
Inserts new rows before the marked row. The number of rows to be inserted can be defined in an entry window.



Remote-control command: n.a.

Fill....

Opens a sub menu for defining a set of list values to be automatically entered in the ucor list.



The start line and the number of rows to be filled are defined under **From** and **Range**.

The column to be filled is selected under **Select column to fill**. Depending on the selection here, the default for start, end, and increment value are set. As the settings are interdependent, a change of one parameter may result in the automatic change of one or more of the other parameters.

The filling of the column with the selected value settings is started with button **Fill**.

Remote-control command: n.a.

Fill With Sensor

Calls the menu to activate the filling of the user correction list with level values acquired by the selected power sensor (see section "*Filling the Correction List with Power Sensor Measurement Data*").

Save

The list is saved under its current name.

Important:
Save a list only after filling both columns (frequency and level), otherwise the entries are lost.

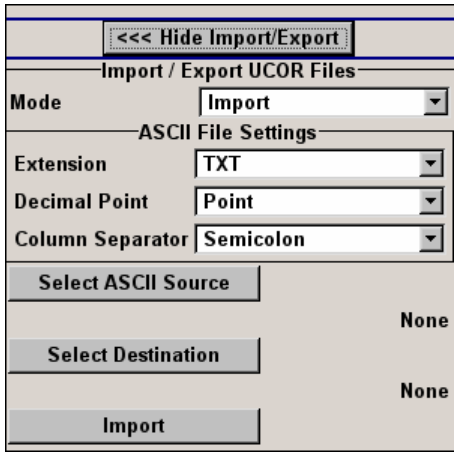
Remote-control command: n.a.
(the list is automatically saved after the values have been entered)

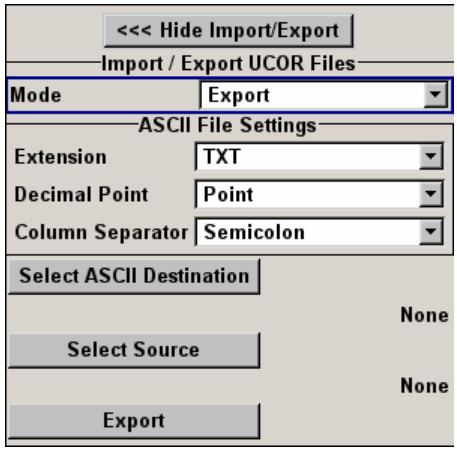
Import/Export - User Correction

Expands the menu with the area for import and export of user correction files.

Externally edited Excel tables with frequency/level pairs can be imported as text or CSV-files and used for user correction.

On the other hand, internally created user correction list can be exported as text or CSV-files.





Mode - User Correction

Selects if user correction lists should be imported or exported. The settings offered depend on the selected mode.

Remote-control command:
`SOUR:CORR:DEXC:MODE IMP`

Extension - User Correction

Selects the file extension of the ASCII file to be imported or exported. Selection TXT (text file) or CSV (Excel file) is available.

Remote-control command:
`SOUR:CORR:DEXC:AFIL:EXT TXT`

Decimal Point - User Correction

Selects the decimal separator used in the ASCII data between '.' (decimal point) and ',' (comma) with floating-point numerals.

Remote-control command:
`SOUR:CORR:DEXC:AFIL:SEP:DEC DOT`

Column Separator- User Correction

Selects the separator between the frequency and level column of the ASCII table the user correction list is exported to or imported from.

Remote-control command:
`SOUR:CORR:DEXC:AFIL:SEP:COL TAB`

Select ASCII Source / Destination - User Correction

Calls the **File Manager** for selecting the ASCII file to be imported into a user correction list (source) or the ASCII file the user correction list is exported (destination) in.

Remote-control command:
`SOUR:CORR:DEXC:AFIL:SEL "d:/user/ucor/list1.txt"`

Destination / Source - User Correction

Calls the **File Manager** for selecting the user correction list to be exported (source) into an ASCII file or the destination for the ASCII file to be imported (destination) in.

Remote-control command:
`SOUR:CORR:DEXC:SEL "d:/user/ucor/list1.txt"`

Import / Export - User Correction

Starts the export or import of the selected file.

When import is selected, the ASCII file is imported as user correction list.

When export is selected, the user correction list is exported into the selected ASCII file.

Remote-control command:
`SOUR:CORR:DEXC:EXEC`

Filling the Correction List with Power Sensor Measurement Data

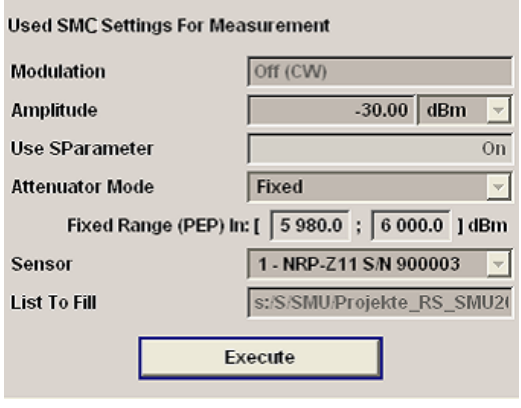
The level correction values for the user correction list can be acquired by means of R&S NRP power sensors. The NRP sensor isconnected to one of the USB interfaces. Configuration of the connection is performed in the **Power Sensor** menu (see "*Power Viewer*"). The filling of the ucor list with measurement data is performed in the ucor list editor (see above "*Edit/New User Correction Data - User Correction*").

In the editor, the frequencies for which the correction values are to be acquired are entered in the frequency column (either manually or by means of the **Fill…** menu).

Note:
Do not save the list at this point, because the frequency entries are lost as long as there are no entries for the level column also. In the following these entries are automatically acquired by the connected power sensor.

All level correction values for the given frequency values are measured using the power sensor and automatically filled in the selected list. The list is automatically stored and recalled again after filling.

The **Fill with Sensor** button of the **Edit User Correction Data** menu opens the associated menu.



The menu indicates the relevant generator settings. The **Execute** button is only enabled if a sensor is detected and the user correction list contains at least one frequency value.

Remote-control command:
`SOUR:CORR:CSET:DATA:SENS:POW:SONC`

Sweep Mode

The R&S SMC Signal Generator offers three different sweep types (frequency sweep, level sweep and LF sweep) to be activated alternatively. Each type has 6 modes which differ with respect to the sweep cycle mode (continuous, individual and step-by-step) and triggering mode (automatic, internal and external).

The LF sweep is activated and configured in the **Mod Gen** block.

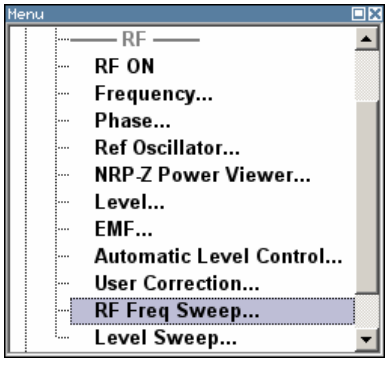
A sweep is set in five basic steps which are shown below taking a frequency sweep as an example:

1. Set the sweep range (**Start Freq** and **Stop Freq** or **Center Freq** and **Span**).
2. Select linear or logarithmic sweep spacing (**Spacing**).
3. Set the step width (**Step Lin**/**Log**) and dwell time (**Dwell Time**).
4. Activate the sweep (**Mode** to **Auto**, **Single**, **Step** or **Extern Single**, **Extern Step**).
5. Trigger the sweep, except for Auto mode (**Execute Single Sweep**, **Current Frequency** or **External Trigger Signal**).

Note:
It is recommended to switch off the GUI update (Setup menu) for optimum sweep performance especially with short dwell times.

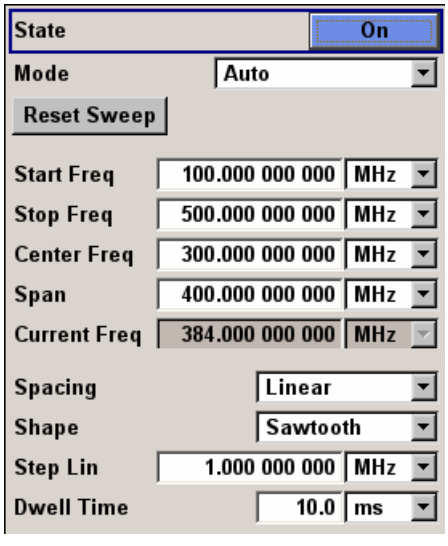
Frequency Sweep Menu

The **Frequency Sweep** menu is opened in the **RF** function block or in the menu tree of the SETUP key under **RF Signal**.



In the top section of the menu, the RF sweep mode is activated and the sweep mode is selected.

The buttons are used to reset the RF sweep (all sweep modes) or to execute the RF sweep (**Single** mode).



The sweep range, sweep spacing and dwell time are set in the bottom section.

The sweep range of the RF sweep can be entered in two ways, either by entering the **Start** and **Stop** value or by entering the **Center** and **Span**. The two sets of parameters influence each other in the following way:

Start = (Center - Span/2)
Stop = (Center + Span/2)
Center = (Start + Stop)/2
Span = (Stop - Start)

State – RF Frequency Sweep

Activates/deactivates RF sweep mode.

Note:
Activating the RF frequency sweep automatically deactivates the LF sweep and Level sweep.

Remote-control commands:
```
SOUR:FREQ:MODE SWE
SOUR:FREQ:MODE CW
```

Mode – RF Frequency Sweep

Selects the Sweep instrument operating mode and the Sweep mode.

Auto

Sets an automatically repeated sweep cycle. If a different sweep mode was activated prior to the **Auto** mode, the cycle continues from the current sweep setting.

The **Reset** button resets the sweep to the start frequency.

Remote-control commands:
```
SOUR:SWE:FREQ:MODE AUTO
TRIG:FSW:SOUR AUTO
SOUR:FREQ:MODE SWE
```

Single

Sets a single sweep cycle. The sweep is triggered by the **Execute Single Sweep** button.

If a different sweep mode was activated prior to the **Single** mode, the current sweep is stopped. The **Single** sweep always starts at the start frequency when triggered.

The **Reset** button stops the sweep and resets it to the start frequency.

Remote-control commands:
```
SOUR:SWE:FREQ:MODE AUTO
TRIG:FSW:SOUR SING
SOUR:FREQ:MODE SWE
SOUR:SWE:FREQ:EXEC
```

Step

Sets a step-by-step sweep cycle.

If this mode is activated, the cursor moves to the value displayed for **Current Freq**. Any variation to the **Current Freq** value triggers a sweep step. The step width is set below at entry field **Step Lin** or **Step Log**.

If a different sweep mode was activated prior to the **Step** mode, the current sweep is stopped. The **Step** sweep starts at the current RF frequency.

The **Reset** button resets the sweep to the start frequency.

Remote-control commands:

```
SOUR:SWE:FREQ:MODE MAN
SOUR:FREQ:MODE SWE
SOUR:SWE:FREQ:SPAC LIN
SOUR:SWE:FREQ:STEP:LIN 0.5E4
SOUR:FREQ:MAN 1E6
```

The value entered with command `SOUR:SWE:FREQ:STEP:LIN|LOG` sets the step width. The value entered with command `SOUR:FREQ:MAN` has no effect, the command only triggers the next sweep step. However, the value has to be in the currently set sweep range (start to stop). In remote control only a step-by-step sweep from start to stop frequency is possible.

Extern Single

Sets a single sweep cycle. The sweep is triggered by an external trigger signal.

If a different sweep mode was activated prior to the **Extern Single** mode, the current sweep is stopped. The **Extern Single** sweep always starts at the start frequency when triggered.

The **Reset** button resets the sweep to the start frequency.

The external trigger signal is input at the rear of the instrument (BNC connector INST TRIG).

Remote-control command:

```
SOUR:SWE:FREQ:MODE AUTO
TRIG:FSW:SOUR EXT
SOUR:FREQ:MODE SWE
```

(External trigger)

Extern Step

Sets a step-by-step sweep cycle. Each sweep step is triggered by an external trigger signal (trigger source as described under **Extern Single**). The step width is set below at entry field **Step Lin** or **Step Log**.

If a different sweep mode was activated prior to the **Extern Step** mode, the current sweep is stopped. The **Extern Step** sweep always starts at the start frequency when triggered.

The **Reset** button resets the sweep to the start frequency.

Remote-control command:
```
SOUR:SWE:FREQ:MODE STEP
SOUR:SWE:FREQ:SPAC LIN
SOUR:SWE:FREQ:STEP:LIN 1 MHz
TRIG:FSW:SOUR EXT
SOUR:FREQ:MODE SWE
```
(External trigger)

Extern Start/Stop

Sets an automatically repeated sweep cycle that is started, stopped and restartet by subsequent external trigger events.

The first external trigger signal starts the sweep (Start).

The next external trigger signal stops the sweep at the current frequency (Stop).

The third external trigger signal starts the sweep at the start frequency (Start).

If a different sweep mode was activated prior to the **Extern Start/Stop** mode, the current sweep is stopped and the **Extern Start/Stop** sweep starts at the start frequency when triggered.

The **Reset** button resets the sweep to the start frequency.

The external trigger signal is input at the rear of the instrument (BNC connector INST TRIG).

Remote-control command:
```
SOUR:SWE:FREQ:MODE AUTO
TRIG:FSW:SOUR EAUT
SOUR:FREQ:MODE SWE
```
(External trigger)

The sweep range, sweep spacing and dwell time are set in the bottom section.

Execute Single Sweep – RF Frequency Sweep

(Mode Single only)
Triggers the sweep manually. A manual sweep can only be triggered if **Mode Single** is selected.

Remote-control commands:
```
SOUR:SWE:FREQ:MODE AUTO
TRIG:FSW:SOUR SING
SOUR:FREQ:MODE SWE
SOUR:SWE:FREQ:EXEC
```

Reset Sweep – RF Frequency Sweep

Resets the sweep. The start frequency is set and the next sweep starts from there.

Remote-control command:
```
SWE:RES:ALL
```

Start Freq - RF Frequency Sweep

Sets the start frequency.

Remote-control command:
```
SOUR:FREQ:STAR 100MHz
```

Stop Freq - RF Frequency Sweep

Sets the stop frequency.

Remote-control command:
```
SOUR:FREQ:STOP 500MHz
```

Center Freq - RF Frequency Sweep

Sets the center frequency.

Remote-control command:
```
SOUR:FREQ:CENT 300MHz
```

Span - RF Frequency Sweep

Sets the span.

Remote-control command:
```
SOUR:FREQ:SPAN 400MHz
```

Current Freq - RF Frequency Sweep

Displays the current frequency.

If **Step** is set, the frequency for the next frequency step of the sweep is entered here.

Remote-control command
```
SOUR:FREQ:MAN 300MHz
```

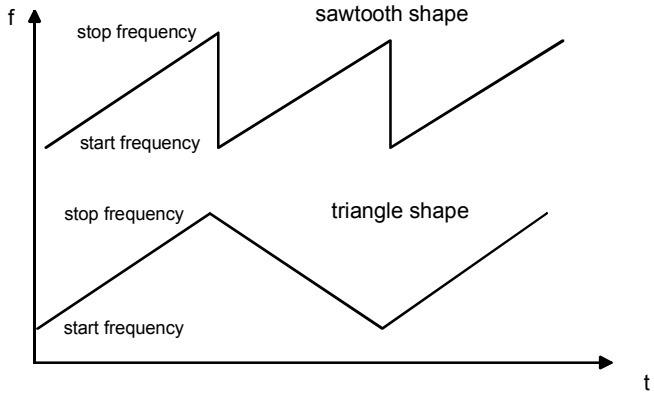
Spacing - RF Frequency Sweep

Selects linear or logarithmic sweep spacing.

Remote-control command:
```
SOUR:SWE:FREQ:SPAC LIN | LOG
```

Shape - RF Frequency Sweep

Selects the cycle mode for a sweep sequence (shape).



Sawtooth One sweep runs from start to stop frequency. Each subsequent sweep starts at the start frequency, i.e. the shape of the sweep sequence resembles a sawtooth.

Remote-control command:
`SOUR:SWE:FREQ:SHAP SAWT`

Triangle One sweep runs from start to stop frequency and back, i.e. the shape of the sweep resembles a triangle. Each subsequent sweep starts at the start frequency.

Remote-control command:
`SOUR:SWE:FREQ:SHAP TRI`

Step Lin/Log - RF Frequency Sweep

Sets the step width for the individual sweep steps. This entry is effective for all sweep modes.

Step Lin or **Step Log** is displayed depending on whether **Spacing Lin** or **Log** is selected.

Step Lin With the linear sweep, the step width is a fixed frequency value which is added to the current frequency. The linear step width is entered in Hz.

Remote-control command:
`SOUR:SWE:FREQ:STEP:LIN 1 MHz`

Step Log With the logarithmic sweep, the step width is a constant fraction of the current frequency. This fraction is added to the current frequency. The logarithmic step width is entered in %.

Remote-control command:
`SOUR:SWE:FREQ:STEP:LOG 1 PCT`

Dwell Time - RF Frequency Sweep

Sets the dwell time. The dwell time determines the duration of the individual sweep steps

Note:
It is recommended to switch off the GUI update for optimum sweep performance especially with short dwell times.

Remote-control command:
`SOUR:SWE:FREQ:DWEL 10ms`

Ext Trigger Input Slope - RF Frequency Sweep

Sets the polarity of the active slope of an applied instrument trigger.

This setting affects the INST TRIG input (BNC connector at the rear of the instrument).

Positive — The rising edge of the trigger signal is active.

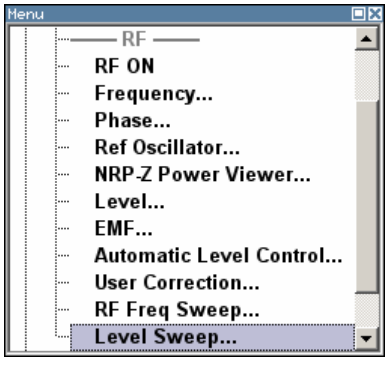
Remote-control command:
`SOUR:INP:TRIG:SLOP POS`

Negative — The falling edge of the trigger signal is active.

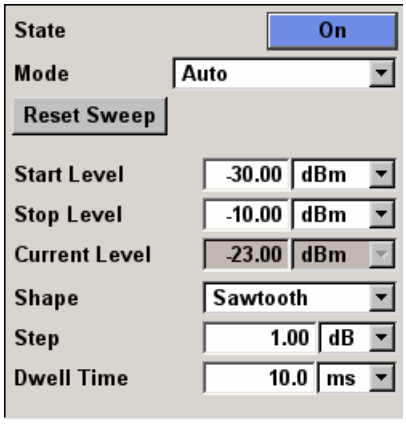
Remote-control command:
`SOUR:INP:TRIG:SLOP NEG`

Level Sweep Menu

The **Level Sweep** menu is opened in the **RF** function block or using the SETUP key under **RF**.



In the top section of the menu, the Level Sweep mode is activated and the level range and the sweep mode are selected. The buttons are used to reset the level sweep (all sweep modes) or to execute the level sweep (**Single** mode).



The sweep range, sweep spacing and dwell time are set in the bottom section.

State - RF Level Sweep

Activates Level Sweep mode.

Note:
Activating the level sweep automatically deactivates the RF sweep and LF sweep.

Remote-control commands:

```
SOUR:POW:MODE SWE
SOUR:POW:MODE CW
```

Mode - RF Level Sweep

Selects the Level Sweep instrument operating mode and the Sweep mode.

Auto

Sets an automatically repeated sweep cycle. If a different sweep mode was activated prior to the **Auto** mode, the cycle continues from the current sweep setting.

The **Reset** button resets the sweep to the start level.

Remote-control commands:
```
SOUR:SWE:POW:MODE AUTO
TRIG:PSW:SOUR AUTO
SOUR:POW:MODE SWE
```

Single

Sets a single sweep cycle. The sweep is triggered by the **Execute Single Sweep** button.

If a different sweep mode was activated prior to the **Single** mode, the current sweep is stopped. The **Single** sweep always starts at the start level.

The **Reset** button stops the sweep and resets it to the start level.

Remote-control commands:
```
SOUR:SWE:POW:MODE AUTO
TRIG:PSW:SOUR SING
SOUR:POW:MODE SWE
SOUR:SWE:POW:EXEC
```

Step

Sets a step-by-step sweep cycle.

If this mode is activated, the cursor moves to the value displayed for **Current Level**. Each sweep step is triggered by a variation of the value in the **Current Level** entry window. The step width is set below at entry field **Step**.

If this mode is activated, the cursor moves to the value displayed for **Current Level**. If a different sweep mode was activated prior to the **Step** mode, the current sweep is stopped. The **Step** sweep starts at the current level value.

The **Reset** button resets the sweep to the start level.

Remote-control commands:
```
SOUR:SWE:POW:MODE MAN
SOUR:POW:MODE SWE
SOUR:SWE:POW:STEP 0.5
SOUR:POW:MAN -15
```

The value entered with command `SOUR:SWE:POW:STEP` sets the step width. The value entered with command `SOUR:POW:MAN` has no effect, the command only triggers the next sweep step. However, the value has to be in the sweep range (start to stop value) In remote control only a step-by-step sweep from start to stop level is possible.

Extern Single

Sets a single sweep cycle. The sweep is triggered by an external trigger signal.

If a different sweep mode was activated prior to the **Extern Single** mode, the current sweep is stopped. The **Extern Single** sweep always starts at the start level.

The external trigger signal is input at the rear of the instrument (BNC connector INST TRIG).

The **Reset** button stops the sweep and resets it to the start level.

Remote-control commands:

```
SOUR:SWE:POW:MODE AUTO
TRIG:PSW:SOUR EXT
SOUR:POW:MODE SWE
```

(External trigger)

Extern Step

Sets a step-by-step sweep cycle. Each sweep step is triggered by an external trigger signal (trigger source as described under **Extern Single**). The step width is set below at entry field **Step**.

If a different sweep mode was activated prior to the **Extern Step** mode, the current sweep is stopped. The **Extern Step** sweep always starts at the start level.

The **Reset** button resets the sweep to the start level.

Remote-control command:

```
SOUR:SWE:POW:MODE STEP
SOUR:SWE:POW:STEP 0.5
TRIG:PSW:SOUR EXT
SOUR:POW:MODE SWE
```

(External trigger)

Extern Start/Stop

Sets an automatically repeated sweep cycle that is started, stopped and restartet by subsequent external trigger events.

The first external trigger signal starts the sweep (Start).

The next external trigger signal stops the sweep at the current level (Stop).

The third external trigger signal starts the sweep at the start level (Start).

If a different sweep mode was activated prior to the **Extern Start/Stop** mode, the current sweep is stopped and the **Extern Start/Stop** sweep starts at the start level when triggered.

The **Reset** button resets the sweep to the start level.

The external trigger signal is input at the rear of the instrument (BNC connector INST TRIG).

Remote-control command:
```
SOUR:SWE:POW:MODE AUTO
TRIG:PSW:SOUR EAUT
SOUR:POW:MODE SWE
```
(External trigger)

Reset Sweep - RF Level Sweep

Resets the sweep. The start level is set and the next sweep starts from there.

Remote-control command:
```
SWE:RES:ALL
```

Execute Single Sweep - RF Level Sweep

Triggers the sweep manually. A manual sweep can only be triggered if **Mode Single** is selected.

Remote-control commands:
```
SOUR:SWE:POW:MODE AUTO
TRIG:PSW:SOUR SING
SOUR:POW:MODE SWE
SOUR:SWE:POW:EXEC
```

The sweep range, sweep spacing and dwell time are set in the bottom section.

Start Level - RF Level Sweep

Sets the start level.

Remote-control command:
`SOUR:POW:STAR -100`

Stop Level – RF Level Sweep

Sets the stop level.

Remote-control command:
`SOUR:POW:STOP -10`

Current Level - RF Level Sweep

Displays the current level.

If **Step** is set, the level for the next level step of the sweep is entered here.

Remote-control command:
`SOUR:POW:MAN -30`

Shape - RF Level Sweep

Selects the cycle mode for a sweep sequence (shape).

Sawtooth One sweep runs from the start level to the stop level. The subsequent sweep starts at the start level again, i.e. the shape of sweep sequence resembles a sawtooth.

Remote-control command:
`SOUR:SWE:POW:SHAP SAWT`

Triangle One sweep runs from start to stop level and back, i.e. the shape of the sweep resembles a triangle.Each subsequent sweep starts at the start level again.

Remote-control command:
`SOUR:SWE:POW:SHAP TRI`

Step - RF Level Sweep

Sets the step width for the individual sweep steps. This entry is effective for all sweep modes.

With the level sweep, the logarithmic step width is a constant fraction of the current level. This fraction is added to the current level. The logarithmic step width is entered in dB.

Remote-control command:
`SOUR:SWE:POW:STEP 3`

Dwell Time - RF Level Sweep

Enters the dwell time. The dwell time determines the duration of the individual sweep steps.

Note:
It is recommended to switch off the GUI update for optimum sweep performance especially with short dwell times.

Remote-control command:
`SOUR:SWE:POW:DWEL 10ms`

Ext Trigger Input Slope

Sets the polarity of the active slope of an applied instrument trigger.

This setting affects the INST TRIG input (BNC connector at the rear of the instrument).

Positive — The rising edge of the trigger signal is active.

Remote-control command:
`SOUR:INP:TRIG:SLOP POS`

Negative — The falling edge of the trigger signal is active.

Remote-control command:
`SOUR:INP:TRIG:SLOP NEG`

Modulations

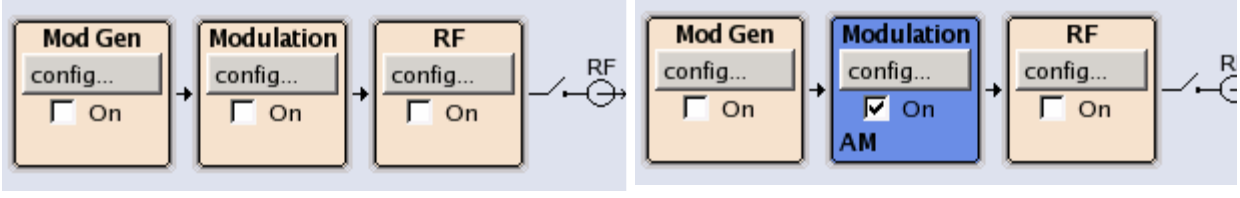
The R&S SMC Signal Generator provides amplitude modulation (AM), frequency modulation (FM), phase modulation (PM) and pulse modulation. In addition, the RF signal can be modulated with internal modulations waveforms.

The modulations are available for the basic unit (R&S SMC + frequency option R&S SMC-B10x) without additional equipment options. A standard LF generator is provided for internal modulation.

Settings for the modulation are made in separate modulation menus. These menus can be accessed in the block diagram by way of the **MOD** function block, or by means of the menu with the same name which is opened using the SETUP key.

The MOD ON/OFF key switches the active modulations on and off. Pressing the key again restores the status that was active before the last switch-off. **MOD OFF** is displayed in the info line of the header next to the **Level** field.

Remote-control command:
`SOUR:MOD:ALL:STAT OFF`



The activated and deactivated state is indicated in the block diagram by means of the different block color and the status of the **On** checkbox. The active modulations are indicated in the block.

Modulation Sources

For amplitude, pulse, frequency and phase modulation the internal and external modulation source can be used.

Internal Modulation Sources

A LF generator and a pulse generator are available as internal modulation sources. The LF generator supplies sinusoidal signals (see also the section "*LF Output Menu*", page 4.98). The pulse generator provides single and double pulse modulation with selectable pulse widths and periods.

External Modulation Sources

The modulation inputs MOD EXT and PULSE EXT at the rear of the instrument are provided as the external modulation source for amplitude, pulse, frequency and phase modulation.

The external modulation signal at the inputs must have a voltage of V_s = 1 V (V_{eff} = 0.707 V) in order to achieve the displayed modulation depth and range. The input voltage should not exceed 1.1 V_s, otherwise modulation distortions might occur. With external pulse modulation, the switching point is max. 2.4 V and the voltage at the input should not exceed 5 V. The maximum modulation frequency is 10 MHz for frequency and phase modulation.

Simultaneous Operation of Several Modulations or Other Operating Modes

The table shows the modulations and operating modes which can be activated simultaneously (+) or which deactivate each other (-).

	AM	FM	PhiM	Pulse
Amplitude modulation (AM)	/	+	+	-
Frequency modulation (FM)	+	/	-	+
Phase modulation (PhiM)	+	-	/	+
Pulse modulation (Pulse)	-	+	+	/

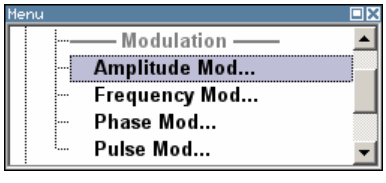
Amplitude Modulation - AM

An internal and/or external source can be selected for amplitude modulation. A LF modulation generator is available as the internal source.

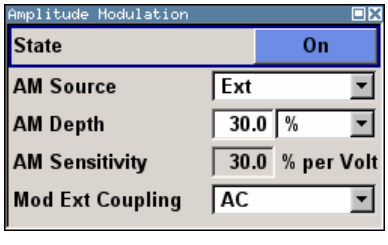
The MOD EXT input connector for external feed of analog modulation signals is at the front of the instrument. The coupling mode of the input (AC or DC) can be selected.

Amplitude Modulation Menu

The **Amplitude Modulation** menu is opened in the **Mod** function block or using the SETUP key under **Mod**.



In the upper section of the menu, the modulation source is selected and the modulation switched on. The modulation source can be selected independently for the different modulation types and the LF output. The configuration of the selected external and/or internal modulation source is performed in the lower section of the menu or in the **Mod Gen** block (internal source only). These settings affect all modulations which use the same modulation source.



State - AM

Activates/deactivates AM modulation.

Remote-control command:
`SOUR:AM:STAT ON`

AM Source - AM

Selects the source for the AM signal.

Int

Selects the internal modulation source for AM modulation.

Remote-control command:
`SOUR:AM:SOUR INT`

Ext

Selects the external source. The external signal is input via the MOD EXT connector.

Remote-control command:
`SOUR:AM:SOUR EXT`

AM Depth

Sets the modulation depth in percent.

Remote-control command:
`SOUR:AM:DEPT 20PCT`

AM Sensitivity

(Source External only)

Displays the input sensitivity of the MOD EXT input in %/V. The display only appears in the case of external modulation.

The modulation depth entered under **AM Depth** is reached with 1 Volt modulation of the input.

Remote-control command:
`SOUR:AM:SENS?` `Response: "30"`

AM Ext Coupling

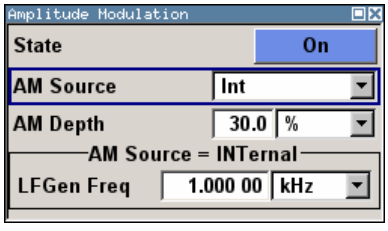
(Source External only)

Selects the coupling mode (AC or DC) for external feed.

Note:
Coupling for external feed via input MOD EXT is set for all modulations with external source.

Remote-control command:
`SOUR:AM:EXT:COUP AC`

In case of selection **Source Int**, the settings for the internal modulation sources are offered in the **AM Source = INTernal** section of the Amplitude Modulation menu. These settings affect all analog modulations which use the same modulation sources.



LF Gen Freq - AM (Source Internal)

Sets the frequency of the LF generator.

Remote-control command:
`SOUR:LFO:FREQ 1E3`

Frequency Modulation - FM

An internal or external source can be selected for frequency modulation. A LF modulation generator is available as internal sources.

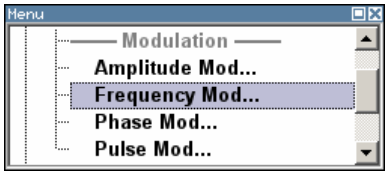
The MOD EXT input connector for external feed of analog modulation signals is at the front of the instrument. The coupling mode of the input (AC or DC) can be selected.

Note:
It is not possible to use frequency modulation simultaneously with phase modulation.

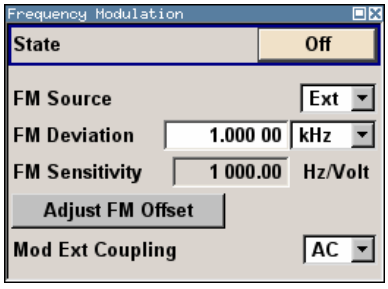
f

Frequency Modulation Menu

The **Frequency Modulation** menu is opened in the **Mod** function block or using the SETUP key under **Mod**.



In the upper section of the menu, the modulation source is selected and the modulation is switched on. The modulation source can be selected independently for the different modulation types and the LF output. The configuration of the selected external or internal modulation source is performed in the lower section of the menu or in the **Mod Gen** block (internal source only). These settings affect all modulations which use the same modulation sources.



State - FM

Activates/deactivates FM modulation.

Activation of FM deactivates phase modulation.

Remote-control command:
`SOUR:FM:STAT ON`

FM Source - FM

Selects the source for the FM signal.

Int

Selects the internal source for FM modulation.

Remote-control command:
`SOUR:FM:SOUR INT`

Ext

Selects the external source for analog frequency modulation. The external signal is input via the MOD EXT connector.

Remote-control command:
`SOUR:FM:SOUR EXT`

FM Deviation

Sets the modulation depth in Hz.

The maximal deviation depends on the RF frequency set and the selected modulation mode (see data sheet). It is possible to enter a deviation that is too high for a certain RF frequency or to vary the RF frequency to a range in which the deviation can no longer be set. In this case the maximally possible deviation is set and an error message is displayed.

Remote-control command:
`SOUR:FM:DEV 1kHz`
`SOUR:FM:EXT:DEV 10kHz`

FM Sensitivity

(Source External only)

Displays the input sensitivity of the MOD EXT input in Hz/V. The display only appears in the case of external modulation.

The modulation depth entered under **FM Depth** is reached with 1 Volt modulation of the input.

Note:
The input voltage should not exceed 1.1 V_s, otherwise modulation distortions might occur.

Remote-control command:
`SOUR:FM:SENS?` `Response: "1E3"`

Adjust FM Offset

Starts the adjustment for the FM/PhiM modulator. The option is adjusted with respect to DC-offset.

Remote-control command:
`CAL:FMOF`
`CAL:FMOF?`

Mod Ext Coupling

(Source External only)

Selects the coupling mode (AC or DC) for external feed.

Note:
Coupling for external feed via input MOD EXT is set for all modulations with external source.

AC

The d.c. voltage content is separated from the modulation signal.

Remote-control command:
`SOUR:FM:EXT:COUP AC`

DC

The modulation signal is dc-coupled.

Remote-control command:
`SOUR:FM:EXT:COUP DC`

LF Gen Freq - FM

(Source Internal)

Sets the frequency of the LF generator.

Remote-control command:
`SOUR:LFO:FREQ 1E3`

Phase Modulation - PhiM

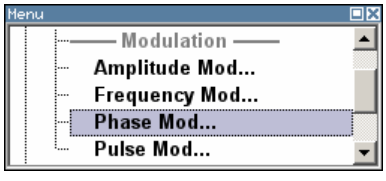
An internal or external source can be selected for phase modulation. A LF modulation generator is available as internal sources.

The MOD EXT input connector for external feed of analog modulation signals is at the front of the instrument. The coupling mode of the input (AC or DC) can be selected.

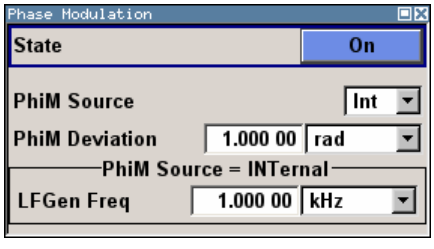
Note:
It is not possible to use phase modulation simultaneously with frequency modulation.

Phase Modulation Menu

The **Phase Modulation** menu is opened in the **Mod** function block or using the SETUP key under **Mod**.



In the upper section of the menu, the modulation source is selected and the modulation switched on. The modulation source can be selected independently for the different modulation types and the LF output. The configuration of the selected external or internal modulation source is performed in the lower section of the menu or in the **Mod Gen** block (internal source only). These settings affect all modulations which use the same modulation sources.



State – PhiM

Activates/deactivates PhiM modulation.

Activation of PhiM deactivates frequency modulation.

Remote-control command:
`SOUR:PM:STAT ON`

PhiM Source

Selects the source for the PhiM signal.

Int

Selects the internal source for PhiM modulation.

Remote-control command:
`SOUR:PM:SOUR INT`

Ext

Selects the external source for analog phase modulation. The external signal is input via the MOD EXT connector.

Remote-control command:
`SOUR:PM:SOUR EXT`

PhiM Deviation

Sets the modulation deviation in RAD.

The maximal deviation depends on the RF frequency set and the selected modulation mode (see data sheet). It is possible to enter a deviation that is too high for a certain RF frequency or to vary the RF frequency to a range in which the deviation can no longer be set. In this case the maximally possible deviation is set and an error message is displayed.

Remote-control command:
```
SOUR:PM:DEV  2.5
SOUR:PM:EXT:DEV 2.5
```

PhiM Sensitivity

(Source External only)

Displays the input sensitivity of the MOD input in RAD/V. The display only appears in the case of external modulation.

The modulation depth entered under **PhiM Depth** is reached with 1 Volt modulation of the input.

Note:
The input voltage should not exceed 1.1 V_s, otherwise modulation distortions might occur.

Remote-control command:
```
SOUR:PM:SENS?
```

PhiM External Coupling

(Source External only)

Selects the coupling mode (AC or DC) for external feed.

Note:
Coupling for external feed via input MOD EXT is set for all modulations with external source.

AC

The DC voltage content is separated from the modulation signal.

Remote-control command:
```
SOUR:PM:EXT:COUP AC
```

DC

The modulation signal is not altered.

Remote-control command:
```
SOUR:PM:EXT:COUP DC
```

LF Gen Freq - PhiM

(Source Internal)

Sets the frequency of the LF generator.

Remote-control command:
```
SOUR:LFO:FREQ 1E3
```

Pulse Modulation

An internal or external source can be selected for pulse modulation. A pulse generator is available as internal sources.

In case of external source, the external signal is input via the PULSE EXT connector at the rear of the instrument. In case of internal source, this connector can be used as external trigger or gate signal input for internal pulse modulation. The polarity of the connector can be selected.

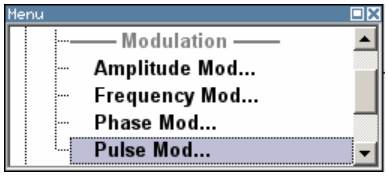
The pulse signal is output at the PULSE VIDEO connector at the rear of the instrument.

Note:

*The level is decreased by 30 dB during **Sample&Hold** measurement!When pulse modulation is activated, the ALC state of the R&S SMC is automatically changed to ALC OFF (Sample & Hold). In this state the ALC loop is opened and the output level is not regulated but the level modulator is set directly. In order to set the correct output level, a sample & hold measurement is executed after each frequency or level setting. The level is decreased by 30 dB during **Sample&Hold** measurement.*

Pulse Modulation Menu

The **Pulse Modulation** menu is opened in the **Mod** function block or using the SETUP key under **Mod**.



In the upper section of the menu, the modulation source is selected and the modulation switched on. The configuration of the selected external and/or internal modulation source is performed in the lower section of the menu.

State - Pulse Modulation

Activates/deactivates pulse modulation.

When the internal modulation source (pulse generator) is selected, the pulse generator is switched on automatically and the video/sync signal is output at the PULSE VIDEO output at the rear of the instrument. Signal output can be switched off in the **Pulse Generator** menu of the **Mod Gen** block.

Remote-control command:

```
SOUR:PULM:STAT ON
```

Source - Pulse Modulation

Selects the source for the pulse modulation signal.

Pulse Generator

Selects the internal pulse generator.

The internally generated rectangular signal is used for the pulse modulation.

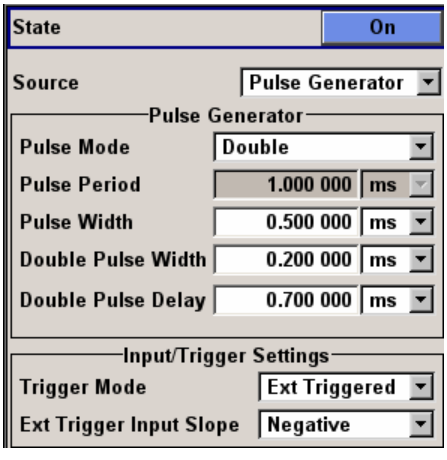
Remote-control command:
`SOUR:PULM:SOUR INT`

External

Selects the external source. The external modulation signal is input via the **PULSE EXT** connector.

Remote-control command:
`SOUR:PULM:SOUR EXT`

In case of modulation source pulse generator, the settings for the pulse characteristics and the trigger are offered in the **Pulse Generator** section of the **Pulse Modulation** menu. Generation of double pulse or selection of trigger mode is offered. The output of the video/sync signal at the PULSE VIDEO output is automatically switched on when activating pulse modulation. It can be switched off in the **Pulse Generator** menu of the **Mod Gen** block.



Polarity - Pulse Modulation

(Source External only)
Selects the polarity of the external modulation signal.

Normal

The RF level is On if the level is High at the modulation input.

Remote-control command:
`SOUR:PULM:POL NORM`

Inverse

The RF level is off if the level is High at the modulation input.

Remote-control command:
`SOUR:PULM:POL INV`

Pulse Mode - Pulse Generator

(Source Pulse Generator only)

Selects and activates the pulse mode.

Single — A single pulse is generated in one pulse period.

Remote-control command:
`SOUR:PULM:MODE SING`

Double — Two pulses are generated in one pulse period. Additional settings for the double pulse are available in the menu.

Remote-control command:
`SOUR:PULM:MODE DOUB`

Pulse Period - Pulse Generator

Sets the period of the generated pulse. The period determines the repetition frequency of the internal signal.

Remote-control command:
`SOUR:PULM:PER 0.05ms`

Pulse Width - Pulse Generator

Pulse width

Sets the width of the generated pulse. The width determines the pulse length. The pulse width must be at least 20 ns less than the set pulse period.

Remote-control command:
`SOUR:PULM:WIDT 22ms`

Pulse Delay - Pulse Generator

(External trigger only)

Sets the pulse delay. The pulse delay determines the time that elapses after a trigger event before pulse modulation starts. The pulse delay is not effective for double pulse generation.

Remote-control command:
`SOUR:PULM:DEL 22µs`

Double Pulse Width - Pulse Generator

(Double Pulse only)

Sets the width of the second pulse in case of double pulse generation.

Remote-control command:
`SOUR:PULM:DOUB:WIDT 33 µs`

Double Pulse Delay - Pulse Generator

(Double Pulse only)

Sets the delay from the start of the first pulse to the start of the second pulse.

Remote-control command:
`SOUR:PULM:DOUB:DEL 22µs`

Trigger Mode - Pulse Generator

Selects the trigger mode for pulse modulation.

Auto
The pulse generator signal is generated continuously.

Remote-control command:
`SOUR:PULM:TRIG:MODE AUTO`

Ext Triggered
The pulse generator signal is triggered by an external trigger event. The trigger signal is supplied via the PULSE EXT connector.

Remote-control command:
`SOUR:PULM:TRIG:MODE EXT`

Ext Gated
The pulse generator signal is gated by an external gate signal. The signal is supplied via the PULSE EXT connector.

Remote-control command:
`SOUR:PULM:TRIG:MODE EGAT`

External Trigger Input Slope - Pulse Generator

(External Trigger only)

Sets the polarity of the active slope of an applied trigger at the PULSE EXT connector.

Positive
The pulse generator is triggered on the positive slope of the external trigger signal.

Remote-control command:
`SOUR:PULM:TRIG:EXT:SLOP POS`

Negative
The pulse generator is triggered on the negative slope of the external trigger signal.

Remote-control command:
`SOUR:PULM:TRIG:EXT:SLOP NEG`

Gate Input Polarity - Pulse Generator

(External Gate only)

Selects the polarity of the Gate signal. The signal is supplied via the PULSE EXT connector.

Positive
The pulse signal is generated while the gate signal is high.

Remote-control command:
`SOUR:PULM:TRIG:EXT:GATE:POL NORM`

Negative
The pulse signal is generated while the gate signal is low.

Remote-control command:
`SOUR:PULM:TRIG:EXT:GATE:POL INV`

LF Generator and LF Output - Mod Gen Block

An LF generator providing sinusoidal signals in the frequency range 0.1 Hz to 1 MHz is available for the basic unit without additional equipment options.

The internal LF generator is the internal source for the analog modulations AM and FM / PhiM, and as the signal source for the LF output at the front of the instrument.

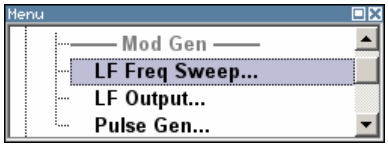
The LF generator settings can be made both in the modulation menus and in the **LF Output** menu. The settings are effective for all modulations using the internal modulation source. For example, a change to the frequency of the LF generator automatically has an effect on AM modulation if internal source is selected as the AM modulation source (i.e. **Int** is selected as **Source**).

The LF Sweep mode is activated in the **LF Sweep** menu. RF frequency and level sweeps are activated in the respective menus of the RF block.

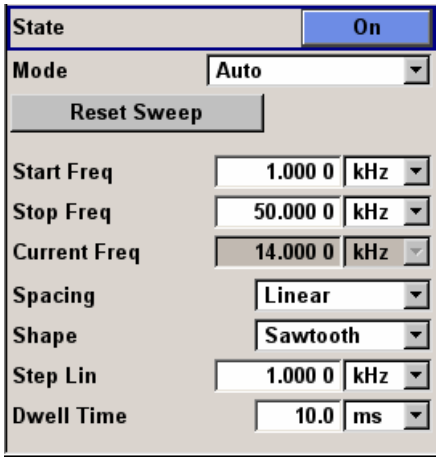
The internal pulse gnenerator enables the generation of single and double pulse signals. The generator is activated and configured in the **Pulse Generator** menu of the **LF output** block or in the **Pulse Modulation** menu of the **Mod** block (**Pulse Generator** is selected as **Source**).

LF Frequency Sweep Menu

The **LF Frequency Sweep** menu is opened in the **Mod Gen** function block or using the SETUP key under **LF Gen**.



In the top section, the LF Sweep mode is activated and the sweep mode is selected. The buttons are used to reset the LF sweep (all sweep modes) or to execute the LF sweep (**Single** mode).



The sweep range, sweep spacing and dwell time are set in the bottom section.

State - LF Sweep

Activates LF Sweep mode.

Note:
Activating the LF sweep automatically deactivates the RF frequency sweep and level sweep.

Remote-control commands:
```
SOUR:LFO:FREQ:MODE SWE
SOUR:LFO:FREQ:MODE CW
```

Mode - LF Sweep

Selects the Sweep instrument operating mode and Sweep mode.

Auto

Sets an automatic repeated sweep cycle. If a different sweep mode was activated prior to the **Auto** mode, the cycle continues from the current sweep setting.

The **Reset** button resets the sweep to the start frequency.

Remote-control commands:
```
SOUR:LFO:SWE:FREQ:MODE AUTO
TRIG0:SWE:SOUR AUTO
SOUR:LFO:FREQ:MODE SWE
```

Single

Sets a single sweep cycle. The sweep is triggered by the **Execute Single Sweep** button.

If a different sweep mode was activated prior to the **Single** mode, the current sweep is stopped. The **Single** sweep always starts at the start frequency.

The **Reset** button stops the sweep and resets it to the start frequency.

Remote-control commands:
```
SOUR:LFO:SWE:FREQ:MODE AUTO
TRIG0:SWE:SOUR SING
SOUR:LFO:FREQ:MODE SWE
SOUR:LFO:SWE:FREQ:EXEC
```

Step

Sets a step-by-step sweep cycle. Each sweep step is triggered by a variation of the value in the **Current Freq** entry window.

If this mode is activated, the cursor moves to the value displayed for **Current Freq**. If a different sweep mode was activated prior to the **Step** mode, the current sweep is stopped. The **Step** sweep starts at the current LF frequency.

The **Reset** button resets the sweep to the start frequency.

Remote-control commands:

```
SOUR:LFO:SWE:FREQ:MODE MAN
SOUR:LFO:FREQ:MODE SWE
SOUR:LFO:SWE:FREQ:SPAC LIN
SOUR:LFO:SWE:FREQ:STEP:LIN 1E3
SOUR:LFO:FREQ:MAN 12 kHz
```

The value entered with command `SOUR:LFO:SWE:FREQ:STEP:LIN|LOG` sets the step width. The value entered with command `SOUR:LFO:FREQ:MAN` has no effect, the command only sets the next sweep step. In remote control only a step-by-step sweep from start to stop frequency is possible.

Extern Single

Sets a single sweep cycle. The sweep is triggered by an external trigger signal.

If a different sweep mode was activated prior to the **Extern Single** mode, the current sweep is stopped. The **Extern Single** sweep always starts at the start frequency.

The **Reset** button resets the sweep to the start frequency.

The external trigger signal is input at the rear of the instrument (BNC connector INST TRIG).

Remote-control command:

```
SOUR:LFO:SWE:FREQ:MODE AUTO
TRIG0:SWE:SOUR EXT
SOUR:LFO:FREQ:MODE SWE
```

(External trigger)

Extern Step

Sets a step-by-step sweep cycle. Each sweep step is triggered by an external trigger signal (trigger source as described under **Extern Single**). The step width is set below at entry field **Step Lin** or **Step Log**.

If a different sweep mode was activated prior to the **Extern Step** mode, the current sweep is stopped. The **Extern Step** sweep always starts at the LF start frequency.

The **Reset** button resets the sweep to the start frequency.

Remote-control commands:

```
SOUR:LFO:SWE:FREQ:MODE STEP
SOUR:LFO:SWE:FREQ:SPAC LIN
SOUR:LFO:SWE:FREQ:STEP LIN 1E3
TRIG0:SWE:SOUR EXT
SOUR:LFO:FREQ:MODE SWE
```

(External trigger)

Extern Start/Stop

Sets an automaticly repeated sweep cycle that is started, stopped and restartet by subsequent external trigger events.

The first external trigger signal starts the sweep (Start).

The next external trigger signal stops the sweep at the current frequency (Stop).

The third external trigger signal starts the sweep at the start frequency (Start).

If a different sweep mode was activated prior to the **Extern Start/Stop** mode, the current sweep is stopped and the **Extern Start/Stop** sweep starts at the start frequency when triggered.

The **Reset** button resets the sweep to the start frequency.

The external trigger signal is input at the rear of the instrument (BNC connector INST TRIG).

Remote-control command:

```
SOUR:LFO:SWE:FREQ:MODE AUTO
TRIG0:SOUR EAUT
SOUR:LFO:FREQ:MODE SWE
```

(External trigger)

Reset Sweep - LF Sweep

Resets the sweep. The start frequency is set and the next sweep starts from there.

Remote-control command:

```
SWE:RES:ALL
```

Execute Single Sweep - LF Sweep

Triggers the sweep manually. A manual sweep can only be triggered if **Mode Single** is selected.

Remote-control commands

```
SOUR:LFO:SWE:FREQ:MODE AUTO
TRIG0:SWE:SOUR SING
SOUR:LFO:FREQ:MODE SWE
SOUR:LFO:SWE:FREQ:EXEC
```

The sweep range, sweep spacing, dwell time and the external trigger slope are set in the bottom section.

Start Freq - LF Sweep

Sets the start frequency.

Remote-control command:

```
SOUR:LFO:FREQ:STAR 100kHz
```

Stop Freq - LF Sweep

Sets the stop frequency.

Remote-control command:

```
SOUR:LFO:FREQ:STOP 50kHz
```

Current Freq - LF Sweep

Displays the current frequency.

If **Step** is set, the frequency for the next frequency step of the sweep is entered here.

Remote-control command

```
SOUR:LFO:FREQ:MAN  15 kHz
```

Spacing - LF Sweep

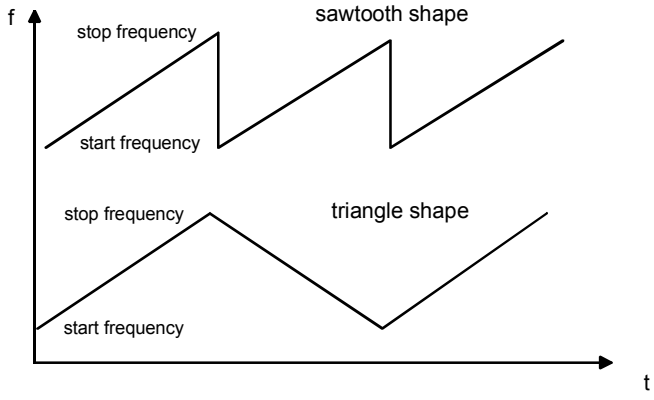
Selects linear or logarithmic sweep spacing.

Remote-control command:

```
SOUR:LFO:SWE:FREQ:SPAC LIN | LOG
```

Shape - LF Sweep

Selects the cycle mode for a sweep sequence (shape).



Sawtooth One sweep runs from start to stop frequency. Each subsequent sweep starts at the start frequency, i.e. the shape of the sweep sequence resembles a sawtooth.

Remote-control command:
`SOUR:LFO:SWE:FREQ:SHAP SAWT`

Triangle One sweep runs from start to stop frequency and back, i.e. the shape of the sweep resembles a triangle. Each subsequent sweep starts at the start frequency.

Remote-control command:
`SOUR:LFO:SWE:FREQ:SHAP TRI`

Step Lin/Log - LF Sweep

Sets the step width for the individual sweep steps. This entry is effective for all sweep modes.

Step Lin or **Step Log** is displayed depending on whether **Spacing Lin** or **Log** is selected.

Step Lin With the linear sweep, the step width is a fixed frequency value which is added to the current frequency. The linear step width is entered in Hz.

Remote-control command:
`SOUR:LFO:SWE:FREQ:STEP:LIN 1 kHz`

Step Log With the logarithmic sweep, the step width is a constant fraction of the current frequency. This fraction is added to the current frequency. The logarithmic step width is entered in %.

Remote-control command:
`SOUR:LFO:SWE:FREQ:STEP:LOG 1 PCT`

Dwell Time - LF Sweep

Sets the dwell time. The dwell time determines the duration of the individual sweep steps.

Note:
It is recommended to switch off the GUI update for optimum sweep performance especially with short dwell times.

Remote-control command:
`SOUR:LFO:SWE:FREQ:DWEL 10ms`

Ext Trigger Input Slope - LF Sweep

Sets the polarity of the active slope of an applied instrument trigger.

This setting affects the INST TRIG input (BNC connector at the rear of the instrument).

Positive — The rising edge of the trigger signal is active.

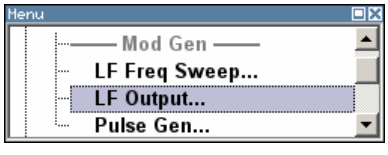
Remote-control command:
`SOUR:INP:TRIG:SLOP POS`

Negative — The falling edge of the trigger signal is active.

Remote-control command:
`SOUR:INP:TRIG:SLOP NEG`

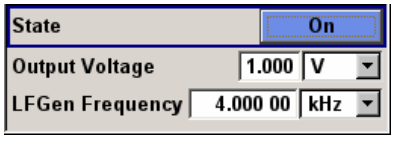
LF Output Menu

The **LF Output** menu is opened in the **Mod Gen** function block or using the SETUP key under **Mod Gen**.



The **LF Output** menu provides access to the configuration of the internal modulation generators. In addition, the LF output is configured in this menu. The available settings depend on the source selected and on the installed options.

In the upper section of the menu, the LF output is switched on. The configuration of the internal source is performed in the lower section of the **LF Output** menu or in the individual modulation menus of the **Mod** block (e.g. Amplitude Modulation menu). These settings affect all modulations which use the same modulation sources and the LF output.



State - LF Output

Activates/deactivates the LF Output.

The modulation signal is output at the LF output connector at the front of the instruments.

Remote-control command:
`SOUR:LFO:STAT ON`

Output Voltage - LF Output

Sets the output voltage of the LF output. The entered value determines the peak voltage.

Remote-control command:
`SOUR:LFO:VOLT 1 V`

LF Gen Freq - LF Output

Sets the frequency of the LF generator.

This setting affects all analog modulations which use the LF generator as the internal modulation source.

Remote-control command:
`SOUR:LFO:FREQ 1E3`

Pulse Generator Menu

The **Pulse Generator** menu is opened in the **Mod Gen** function block or using the SETUP key under **Mod Gen**. The same settings can be made in the **Pulse Modulation** menu of the **MOD** block. Please refer to the description of the menu in section "*Pulse Modulation*", page 4.88.

Video Sync Signal State - Pulse Generator

Switches on/off the output of the video/sync signal at the **PULSE VIDEO** connector. Pulse modulation of the RF carrier is activated in the **Pulse modulation** menu of the **Modulation** block..

Remote-control command:
`SOUR:PGEN:STAT ON`

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5 Remote Control - Basics

Introduction - Remote Control Basics

This chapter provides:

- Instructions on how to set up the signal generator for remote control operation.
- A general introduction to remote control of programmable instruments. This includes the description of the command structure and syntax according to the SCPI standard, the description of command execution and of the status registers.

In chapter "*Remote Control - Commands*" all remote control functions are described in detail. The subsystems are listed by alphabetical order according to SCPI. SCPI (Standard Commands for Programmable Instruments) commands – instrument-control commands – are used for remote control.

The instrument is equipped with the following interfaces for remote control:

- IEC/IEEE bus interface according to standard IEC 625.1/IEEE 488.2.
- LAN interface: the network card uses 100 MHz Ethernet IEEE 802.3u; the protocol is based on the VXI-11 standard.
- USB interface: The type B interface (device USB) is used for remote control.

The connectors are located at the rear of the instrument and permit a connection to a controller for remote control either via GPIB, via a local area network (LAN) or via an USB interfaceUSB. The remote control interfaces and their interface functions are described in Chapter "*Maintenance and Remote Control Interfaces*".

A VISA installation on the controller is a prerequisite for remote control over LAN or USB interface. VISA is a standardized software interface library providing input and output functions to communicate with instruments. For more information about VISA refer to the user documentation.

SCPI (**S**tandard **C**ommands for **P**rogrammable **I**nstruments) commands - messages - are used for remote control. Commands that are not taken from the SCPI standard follow the SCPI syntax rules. The instrument supports the SCPI version 1999. The SCPI standard is based on standard IEEE 488.2 and aims at the standardization of device-specific commands, error handling and the status registers. The tutorial "Automatic Measurement Control – A tutorial on SCPI and IEEE 488.2" from John M. Pieper (R&S order number 0002.3536.00) offers detailed information on concepts and definitions of SCPI.

This section assumes basic knowledge of programming and operation of the controller. A description of the interface commands can be obtained from the relevant manuals.

The requirements that the SCPI standard places on command syntax, error handling and configuration of the status registers are explained in detail in the following sections. Tables provide a fast overview of the bit assignment in the status registers. The tables are supplemented by a comprehensive description of the status registers.

The program examples for IEC/IEEE-bus programming are all written in VISUAL BASIC. A condition for programming in VISUAL BASIC is that the modules NIGLOBAL (Niglobal.bas) and VBIB32 (Vbib_32.bas) are added to the projects.

Note:

*Manual control is designed for maximum possible operating convenience. In contrast, the priority of remote control is the "predictability" of the device status. Therefore, control programs should always define an initial device status (e.g. with the command *RST) and then implement the required settings.*

Drivers for the generator, e.g. IVI-COM and LabVIEW drivers, are available in the download area of the R&S product website (http://www.rohde-schwarz.com/product/SMC100A)

Getting Started

The short and simple operating sequence given below permits fast putting into operation of the instrument and setting of its basic functions. As a prerequisite, the IEC/IEEE-bus address, which is factory-set to 28, must not have been changed.

1. Connect instrument and controller using IEC/IEEE-bus cable and switch them on.
2. Write and start the following program on the controller:

```
CALL IBFIND("DEV1", generator%)            'Open port to the instrument
CALL IBPAD(generator%, 28)                 'Inform controller about instrument address
CALL IBWRT(generator%, "*RST;*CLS")        'Reset instrument
CALL IBWRT(generator%, "FREQ 50MHz")       'Set frequency to 50 MHz
CALL IBWRT(generator%, "POW -7.3dBm")      'Set output level -7.3m dBm
CALL IBWRT(generator%, "OUTP:STAT ON")     'Switch on RF output
CALL IBWRT(generator%, "AM:SOUR INT")      'Set AM modulation source LFGEN
CALL IBWRT(generator%, "LFO:FREQ 15kHz")   'Set modulation frequency to 15 kHz
CALL IBWRT(generator%, "AM 30PCT")         'Set AM modulation depth 30%
CALL IBWRT(generator%, "AM:STAT ON")       'Switch on AM
```

3. An amplitude-modulated signal is now applied at the RF-output of the instrument.
4. To return to manual control, press the LOCAL key at the front panel.

Switchover to Remote Control

On power-on, the instrument is always in the manual operating state and can be operated via the front panel controls or via mouse and external keyboard.

In case of remote control via the IEC/IEEE bus, the instrument is set to remote control (REMOTE status) by means of an addressed command.

With remote control via Ethernet, remote control is not automatically set by means of a command. The instrument must be explicitly set to the REMOTE state, e.g. by sending the interface command **&GTR** (go to remote).

In the REMOTE state, instrument control from the front panel or via mouse and keyboard is disabled. Menus can be opened, however, e.g. to verify settings. Buttons and setting fields are displayed in gray and cannot be activated. REMOTE is displayed in the status line.

The instrument remains in the REMOTE mode until local control is selected either manually with the LOCAL key on the front panel or with the interface command **&GTL** via the remote-control interface.

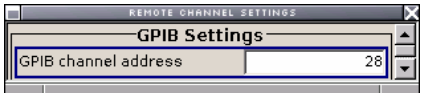
Switching from manual operation to remote control and vice versa does not affect the remaining instrument settings. In the remote control mode, the front-panel keys and an external mouse or keyboard that may be connected can be disabled with command `:SYST:KLOC ON`. Menus cannot be opened in this case and switchover from remote control to manual operation is only possible by means of a remote-control command. Inadvertent switchover with the LOCAL key is not possible in this case.

Operation of the LOCAL key alone can be disabled with interface command **&LLO**.

Remote Control via IEC/IEEE Bus

To be able to control the instrument via the IEC/IEEE bus, instrument and controller must be linked by an IEC/IEEE-bus cable. An IEC/IEEE-bus card, the card drivers and the program libraries for the programming language used must be provided in the controller. The controller must address the instrument with the set IEC/IEEE-bus address. The IEC/IEEE bus address of the instrument is factory-set to 28. It can be changed manually in the **Environment - GPIB** menu or via IEC/IEEE bus with command `SYSTem:COMMunicate:GPIB: ADDRess` . Addresses 0 to 30 are permissible.

Manually: **Setup - Remote - GPIB ...**



Via IEC/IEEE bus:

```
CALL IBFIND("DEV1", generator%)                    'Open port to the instrument
CALL IBPAD(generator%, 28)                         'Inform controller about old address
CALL IBWRT(generator%, "SYST:COMM:GPIB:ADDR 18")   'Set instrument to new address
CALL IBPAD(generator%, 18)                         'Inform controller about new address
```

Sending the first command starts remote control operation.

Return to manual operation is possible via the front panel or the IEC/IEEE bus.

Manually: ➢ *Press the LOCAL key.*

Notes:

Before the transition, command processing must be completed as otherwise transition to remote control is performed immediately.

The LOCAL key can be disabled by the interface message &LLO (see Section "IEC/IEEE Bus Messages") in order to prevent unintentional transition. In this case, transition to manual mode is only possible via the IEC/IEEE bus.

The LOCAL key can be enabled again by deactivating the REN line of the IEC/IEEE bus ((see Section "IEC/IEEE Bus Messages").

Via IEC/IEEE bus:

```
...

CALL IBLOC(generator%)     'Set instrument to manual operation

...
```

Remote Control via LAN Interface

For remote control via a network, the PC and the instrument must be connected via the LAN interface to a common network with TCP/IP network protocol.

Connection of the Signal Generator to a network and the querying of a computer name is described in section "*Connection to the Network*".

Software for instrument control and the VISA program library must be installed on the controller. Instrument control is via the VXI-11 standard protocol.

Only the IP address or the computer name (host name) is required for link setup. The IP address/computer name is part of the "visa resource string" used by the programs for identification and control of the instrument. The visa resource string has the form:

TCPIP::ipaddr::inst0::INSTR

ipaddr has to be replaced by the IP address or the computer name of the instrument.

For instance, if the instrument has the IP address 192.1.2.3, TCPIP::192.1.2.3::inst0::INSTR is the valid resource name. Specification of **inst0** in the resource string is optional. In this example, also TCPIP::192.1.2.3::INSTR is therefore a valid resource string.

A resource string with computer name could be TCPIP::RSSM1::INSTR, for instance.

TCPIP designates the network protocol used and **INSTR** indicates that the VXI-11 protocol is used.

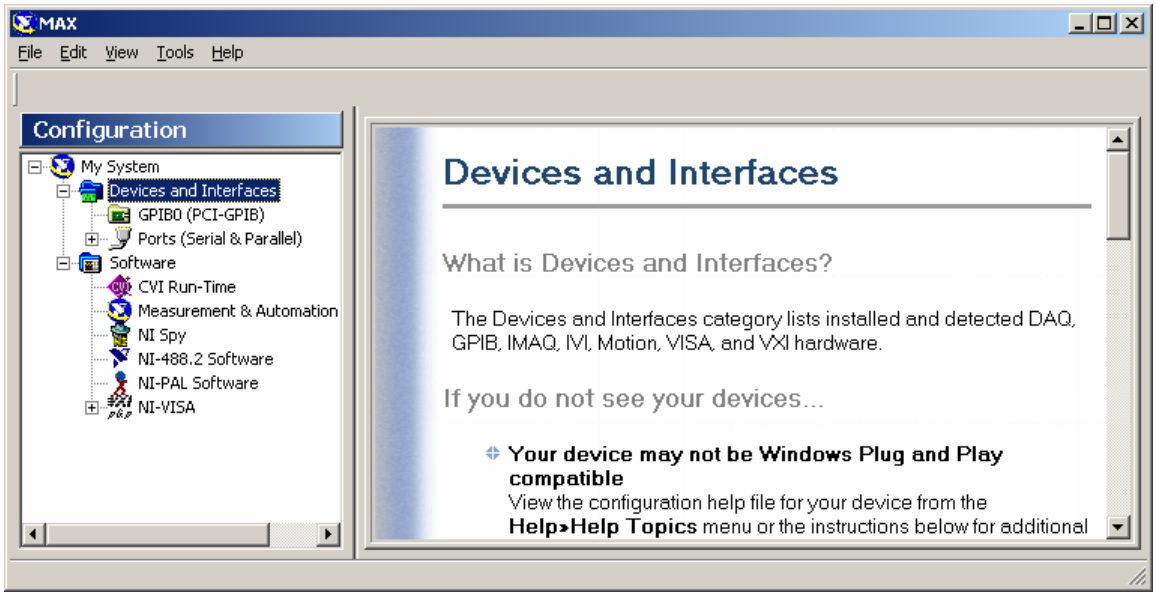
Note:
The visa resource string is indicated in the Setup-Remote -Ethernet menu.

If several instruments are connected to the network, each instrument has its own IP address and associated resource name. The controller identifies these instruments by means of the resource name.

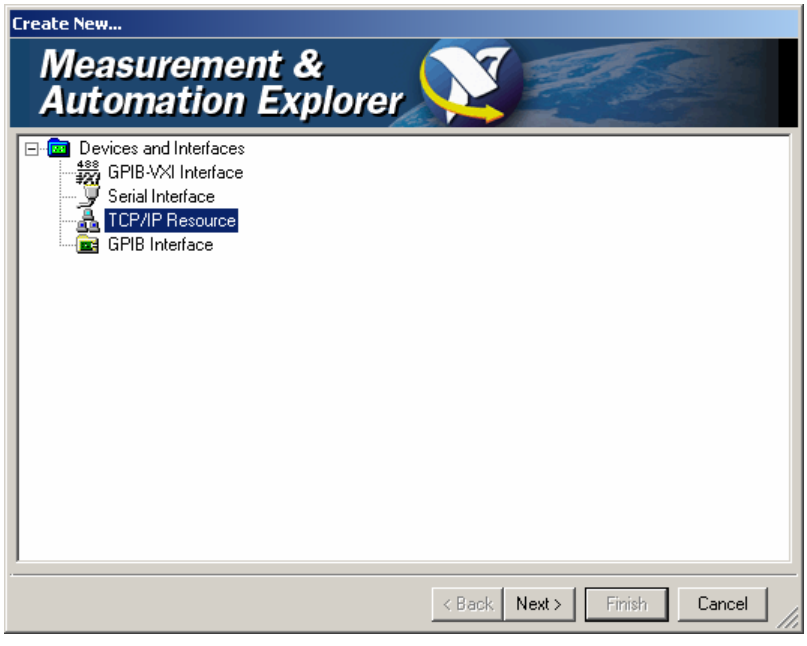
In the example below, the program 'Measurement & Automation Explorer' from National Instruments is used for setting up an Ethernet remote-control link. Link setup with this program is easy and first tests can be performed. The R&S Signal Generator is preconfigured for networks using DHCP (dynamic host configuration protocol). If this configuration is used, the computer name must be entered at the position of the IP address. It is also possible to assign a fixed IP address to the instrument.

Setting up Control of the Signal Generator in the 'Measurement & Automation Control' Program.

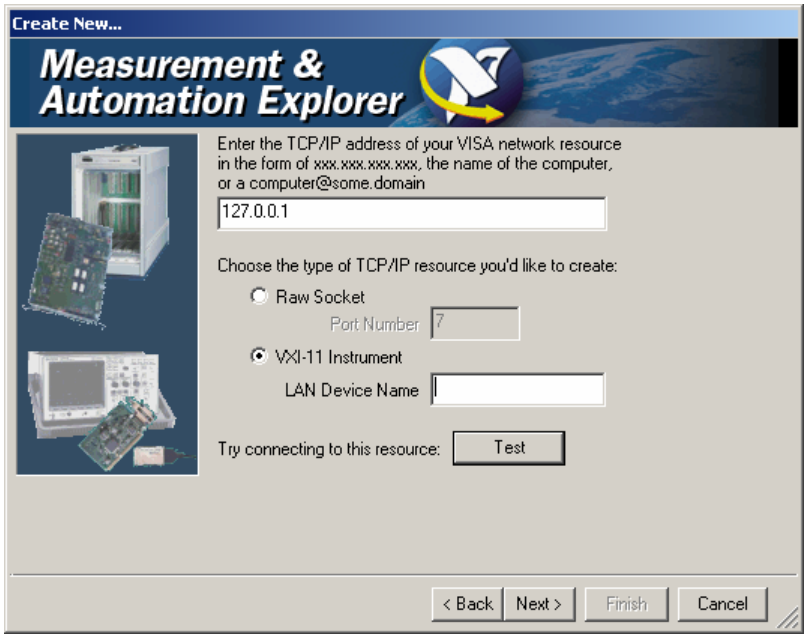
1. Start program on the controller
2. Open the **Create new** menu with the right mouse key.


MAX
File Edit View Tools Help
Configuration
My System
Devices and Interfaces
GPIB0 (PCI-GPIB)
Ports (Serial & Parallel)
Software
CVI Run-Time
Measurement & Automation
NI Spy
NI-488.2 Software
NI-PAL Software
NI-VISA
Devices and Interfaces
What is Devices and Interfaces?
The Devices and Interfaces category lists installed and detected DAQ, GPIB, IMAQ, IVI, Motion, VISA, and VXI hardware.
If you do not see your devices...
Your device may not be Windows Plug and Play compatible
View the configuration help file for your device from the Help>Help Topics menu or the instructions below for additional

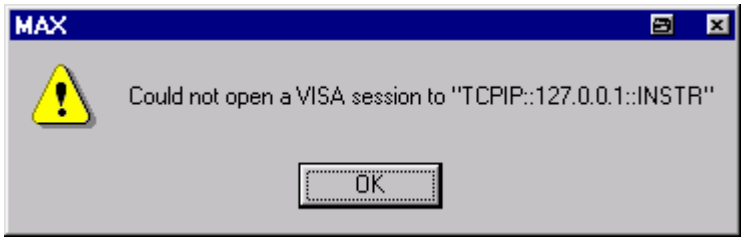
3. Select **TCP/IP Resource** and open the next page of the **Create new** menu with the right mouse key.



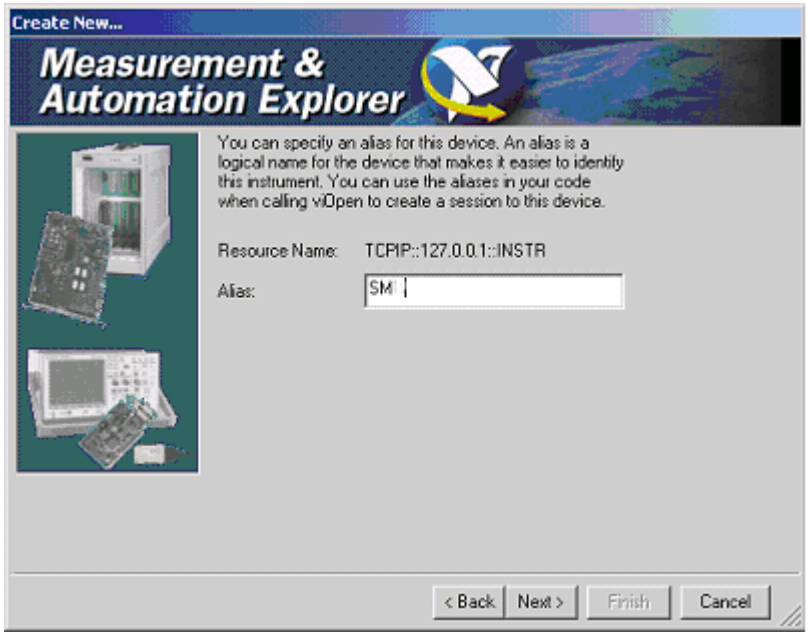
4. Enter the IP address of the Signal Generator and select **VXI-11 Instrument** (the computer name may be entered instead).


Create New...
Measurement & Automation Explorer
Enter the TCP/IP address of your VISA network resource in the form of xxx.xxx.xxx.xxx, the name of the computer, or a computer@some.domain
127.0.0.1
Choose the type of TCP/IP resource you'd like to create:
Raw Socket
Port Number
7
VXI-11 Instrument
LAN Device Name
Try connecting to this resource:
Test
< Back
Next >
Finish
Cancel

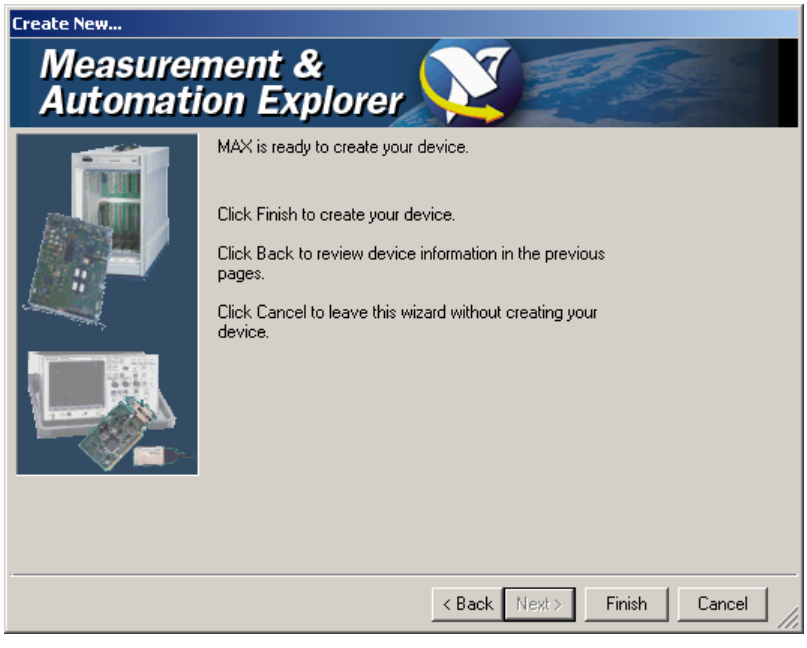
5. Press the **Test** button
A message indicates whether the link to the Signal Generator can be set up or not. If a connection cannot be set up, check whether the controller and the instrument are connected to the network (network cable) and switched on. Correct spelling of the IP address or the computer name can also be checked. For further error location, inform the network administrator. In large networks, specification of additional addresses may be required for link setup, e.g. gateway and subnet mask, which are known to the network administrator.



6. Press the **Next** button. An alias name for the instrument can be entered in the next window. This name must not be mistaken for the computer name. It is only used for instrument identification within the program and displayed in the menu as an option in case of an Ethernet link.

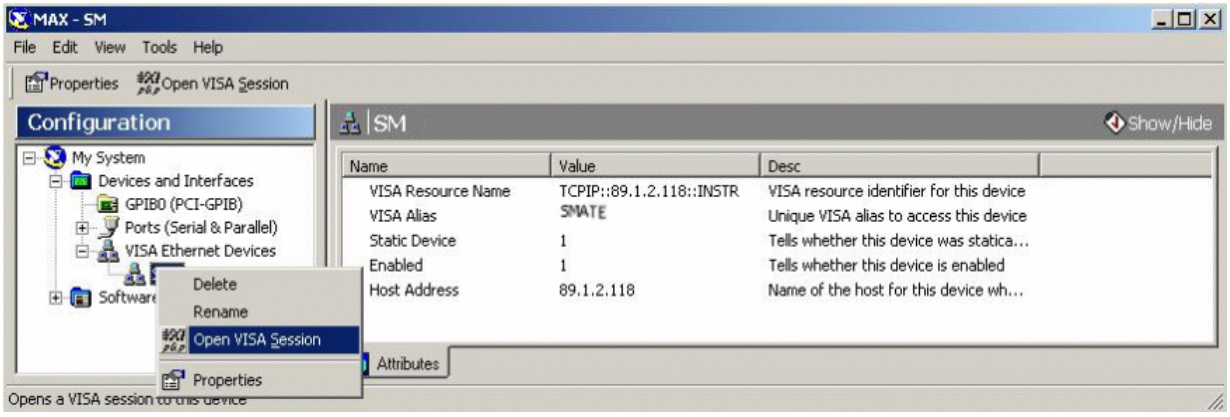

Create New...
Measurement & Automation Explorer
You can specify an alias for this device. An alias is a logical name for the device that makes it easier to identify this instrument. You can use the aliases in your code when calling viOpen to create a session to this device.
Resource Name: TCPIP::127.0.0.1::INSTR
Alias: SM
< Back
Next >
Finish
Cancel

7. Press **Next** and then the **Finish** button.
   The instrument is now registered in the program and can be addressed via the resource or alias name.

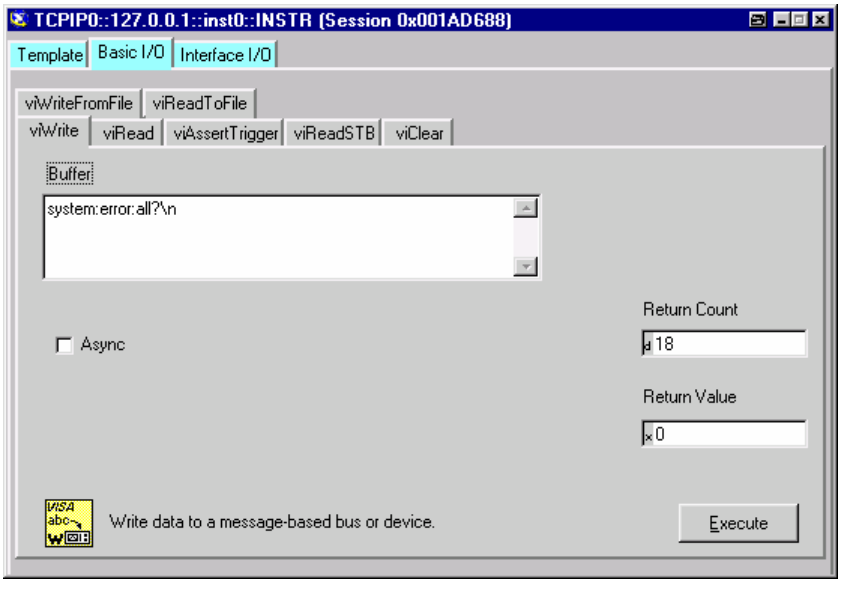

Create New...
Measurement & Automation Explorer
MAX is ready to create your device.
Click Finish to create your device.
Click Back to review device information in the previous pages.
Click Cancel to leave this wizard without creating your device.
< Back
Next >
Finish
Cancel

Starting the Measurement & Automation program for remote control of the Signal Generator

1. Start program on the controller
2. In the **Configuration** window**,** open **Instruments and Interfaces** and select R&S **SM** (= Alias) under **VISA Ethernet Devices**.
3. Open the menu by clicking **Open VISA Session** with the right mouse key.



On the **viWrite** tab under **Basic I/O**, commands can be sent to the instrument; instrument responses are displayed on the **viRead** tab (for further program operation refer to the online help of the program).



4. Return to manual operation is possible via the front panel or the LAN interface.

Manually:

1. Press the LOCAL key.

Notes:

The LOCAL key can be disabled by the universal command &LLO (see Section "IEC/IEEE Bus Messages") in order to prevent unintentional transition. In this case, transition to manual mode is only possible via remote control.

The LOCAL key can be enabled again by the interface message &NREN (see Section "IEC/IEEE Bus Messages").

Via IEC/IEEE bus:

```
...
CALL IBLOC(generator%)    'Set instrument to manual operation
...
```

Remote Control via USB Interface

The PC and the instrument must be connected via the USB type B interface. A USB connection requires the VISA library to be installed on the controller. VISA will detect and configure the R&S SMC automatically when the USB connection is established. No entry of an address string and no separate driver installation is necessary.

The used USB address string is:

USB::<vendor Id>::<product Id>::<serial number>::INSTR

0x0AAD is the vendor Id for Rohde&Schwarz, 0x54 is the product Id for R&S SMC and the serial number is the individual serial number on the rear of the instrument.

Example:

"USB::0x0AAD::0x0054::100001::INSTR"

Interface and Device Messages

The messages transferred via the data lines of the IEC/IEEE-bus (see Section "*IEC/IEEE Bus Interface*") or via a TCP/IP network can be divided into two groups:

- interface messages and
- device messages.

Interface Messages

Interface messages are transferred on the data lines of the IEC/IEEE bus, the ATN control line being active. They are used for communication between controller and instrument and can only be sent by a computer which has the function of an IEC/IEEE bus controller.

Interface commands can be further subdivided into

- universal commands
- addressed commands

Universal commands act on all devices connected to the IEC/IEEE-bus without previous addressing, addressed commands only act on devices previously addressed as listeners. The interface messages relevant to the instrument are listed in Section "*IEC/IEEE Bus Messages*".

If an Ethernet connection is present, signalling via a hardware control line is not required. The IEC/IEEE-bus interface commands are emulated (see "*IEC/IEEE Bus Messages*").

Device Messages (Commands and Device Responses)

Device messages are transferred on the data lines of the IEC/IEEE-bus, the "ATN" control line not being active. ASCII character set is used.

If an Ethernet connection is present, signalling via a hardware control line is not required.

The device messages are equal for the different interfaces (IEC/IEEE bus and Ethernet). A distinction is made according to the direction in which they are sent:

Commands (Program Messages) are messages the controller sends to the instrument. They operate the device functions and request information.

The commands are subdivided according to two criteria:

1. According to the effect they have on the instrument:

Setting commands cause instrument settings such as a reset of the instrument or setting the frequency.

Queries cause data to be provided for output on the IEC/IEEE bus, e.g. for identification of the device or polling a parameter value. Queries are formed by directly appending a question mark to the header.

2. According to their definition in standard IEEE 488.2 and SCPI:

Common Commands are exactly defined as to their function and notation in standard IEEE 488.2. They refer to functions such as management of the standardized status registers, reset and selftest.

Device-specific Commands refer to functions depending on the features of the instrument such as frequency setting. A majority of these commands has also been standardized by the SCPI committee Device-specific extensions following the SCPI rules are permitted by the standard.

Device responses (Response Messages and Service Request) are messages the instrument sends to the controller after a query. They can contain measurement results, instrument settings and information on the instrument status (cf. Section "*Responses to Queries*").

Structure and syntax of the device messages are described in the following Section.

SCPI Command Structure and Syntax

The commands consist of a so-called header and, in most cases, one or more parameters. The header and parameter are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). The headers may consist of several key words. Queries are formed by directly appending a question mark to the header.

Note:
The commands used in the following examples are not in every case implemented in the instrument.

Common Commands Common commands consist of a header preceded by an asterisk "*" and one or more parameters, if any.

Examples:

`*RST`	RESET, resets the device
`*ESE 253`	EVENT STATUS ENABLE, sets the bits of the event status enable register
`*ESR?`	EVENT STATUS QUERY, queries the contents of the event status register.

Device-specific commands

Hierarchy**:** Device-specific commands are of hierarchical structure (see figure below). The different levels are represented by combined headers. Headers of the highest level (root level) have only one key word. This key word denotes a complete command system

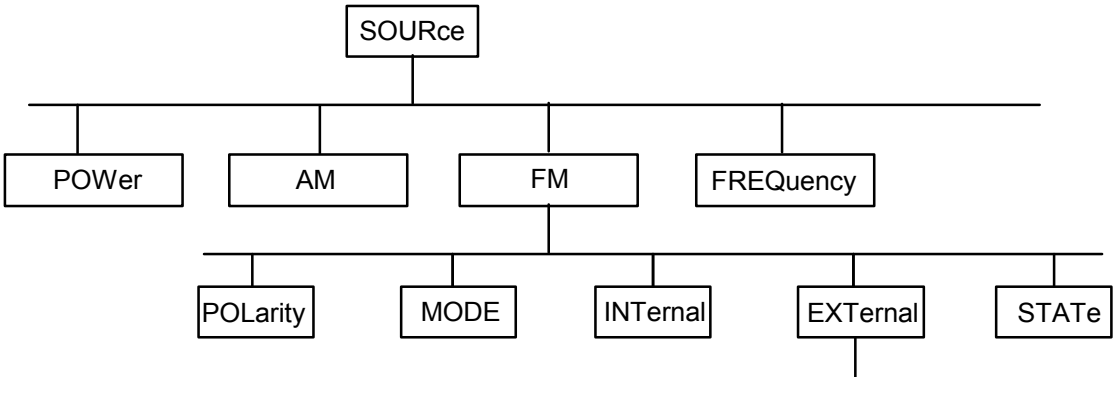
Example: `SOURce`

This key word denotes the command system `SOURce`.

For commands of lower levels, the complete path has to be specified, starting on the left with the highest level, the individual key words being separated by a colon ":".

Example: `SOURce:FM:EXTernal:COUPling AC`

This command lies in the fourth level of the SOURce. It sets the coupling of the external signal source to AC.



Example for the tree structure of the SCPI command systems; the `SOURce` system.

Multiple key words

Some key words occur on several levels within one command system. Their effect depends on the structure of the command, i. e. on the position in the command header they are inserted in.

Example:

```
SOURce:FM:POLarity NORMal
```

This command contains key word POLarity in the third command level. It defines the polarity between modulator and modulation signal.

```
SOURce:FM:EXTernal:POLarity NORMal
```

This command contains key word POLarity in the fourth command level. It defines the polarity between modulation voltage and the resulting direction of the modulation only for the external signal source indicated.

Optional key words:

Some command systems permit certain key words to be optionally inserted into the header or omitted. These key words are marked by square brackets in this manual. The full command length must be recognized by the instrument for reasons of compatibility with the SCPI standard. Some commands are considerably shortened by omitting optional key words.

Example:

```
[SOURce]:POWer[:LEVel][:IMMediate]:Offset 1
```

This command immediately sets the offset of the signal to 1 dB. The following command has the same effect:

```
POWer:Offset 1
```

Long and short form:

The key words feature a long form and a short form. Either the short form or the long form can be entered, other abbreviations are not permitted.

Example: `STATus:QUEStionable:ENABle 1= STAT:QUES:ENAB 1`

Note:

Upper-case and lower-case notation only serves to distinguish the two forms in the manual, the instrument itself does not distinguish upper-case and lower-case letters.

Parameters:

Parameters must be separated from the header by a "white space". If several parameters are specified in a command, they are separated by a comma ",". A few queries permit the parameters MINimum, MAXimum and DEFault to be entered. For a description of the types of parameter, refer to Section "*Parameters*".

Example: `SOURce:POWer:ATTenuation? MAXimum` `Answer: 60`

his query requests the maximal value for the attenuation.

Numeric suffix:

If a device features several functions or features of the same kind, e.g. several inputs, the desired function can be selected by a suffix added to the command. Entries without suffix are interpreted like entries with the suffix 1. Optional keywords must be specified if they select a function with the suffix.

Example:

```
SOURce:LFOutput2:FREQuency 1.5kHz
```

This command sets the frequency of secondLF generator frame.

Structure of a Command Line

A command line may consist of one or several commands. It is terminated by an EOI together with the last data byte.

Several commands in a command line must be separated by a semicolon ";". If the next command belongs to a different command system, the semicolon is followed by a colon. A colon ":" at the beginning of a command marks the root node of the command tree.

Example: "SOURce:POWer:CENTer MINimum;:OUTPut:STATe ON"

This command line contains two commands. The first command is part of the SOURce system and is used to specify the center frequency of the output signal of RF output. The second command is part of the OUTPut system and sets the attenuation of the output signal of RF output.

If the successive commands belong to the same system, having one or several levels in common, the command line can be abbreviated. To this end, the second command after the semicolon starts with the level that lies below the common levels. The colon following the semicolon must be omitted in this case.

Example: "SOURce:FM:INTernal:FREQuency 1kHz;:SOURce:FM:STATe ON"

This command line is represented in its full length and contains two commands separated from each other by the semicolon. Both commands are part of the SOURce command system, subsystem FM, i.e. they have two common levels.

When abbreviating the command line, the second command begins with the level below SOURce:FM. The colon after the semicolon is omitted.

The abbreviated form of the command line reads as follows:

"SOURce:FM:INTernal:FREQuency 1kHz;STATe ON"

However, a new command line always begins with the complete path.

Example: "SOURce:FM:INTernal:FREQuency 1kHz"

"SOURce:FM:STATe ON"

Responses to Queries

A query is defined for each setting command unless explicitly specified otherwise. It is formed by adding a question mark to the associated setting command. According to SCPI, the responses to queries are partly subject to stricter rules than in standard IEEE 488.2.

1. The requested parameter is transmitted without header.

   Example: `SOURce:AM:EXTernal:COUPling?` Response: `AC`

2. Maximum values, minimum values and all further quantities, which are requested via a special text parameter are returned as numerical values

   Example: `SOURce:FREQuency? MAX` Response: `1E3`

3. Boolean values are returned as 0 (for OFF) and 1 (for ON).

   Example: `OUTPut:STATe?` Response(for ON): `1`

4. Text (character data) is returned in a short form

   Example: `SOURce:AM:SOURce?` Response (for EXTernal): `EXT`

Parameters

Most commands require a parameter to be specified. The parameters must be separated from the header by a "white space". Permissible parameters are numerical values, Boolean parameters, text, character strings and block data. The type of parameter required for the respective command and the permissible range of values are specified in the command description.

Numerical values

Numerical values can be entered in any form, i.e. with sign, decimal point and exponent. Values exceeding the resolution of the instrument are rounded up or down. The mantissa may comprise up to 255 characters, the values must be in the value range –9.9E37 to 9.9E37. The exponent is introduced by an "E" or "e". Entry of the exponent alone is not allowed.

Units

In the case of physical quantities, the unit can be entered. Permissible unit prefixes are G (giga), MA (mega), MOHM and MHZ are also permissible), K (kilo), M (milli), U (micro) and N (nano). If the unit is missing, the basic unit is used.

Example:
`SOURce:FREQuency 1.5 kHz = SOURce:FREQuency 1.5E3`

Some settings allow relative values to be stated in percent. According to SCPI, this unit is represented by the `PCT` string.

Example:
`SOURce:SWEep:FREQuency:STEP:LOGarithmic 5PCT`

Special numeric values

The texts MINimum, MAXimum, DEFault, UP and DOWN are interpreted as special numerical values.

In the case of a query, the associated numerical value is provided.

Example:
Setting command: `SOURce:LFOutput:VOLTage MAXimum`

Query: `SOURce:LFOutput:VOLTage?` Answer: `4`

MIN/MAX

`MINimum` and `MAXimum` denote the minimum and maximum value

DEF

`DEFault` denotes a preset value. This value conforms to the default setting, as it is called by the *RST command.

UP/DOWN

`UP`, `DOWN` increases or reduces the numerical value by one step. The step width can be specified via an allocated step command for each parameter which can be set via UP, DOWN.

INF/NINF

`INFinity`, Negative INFinity (`NINF`) represent the numerical values -9.9E37 or 9.9E37, respectively. INF and NINF are only sent as device responses.

NAN

Not A Number (`NAN`) represents the value 9.91E37. NAN is only sent as device response. This value is not defined. Possible causes are division by zero, subtraction or addition of infinite and the representation of missing values.

Boolean Parameters

Boolean parameters represent two states. The on state (logically true) is represented by ON or a numerical value unequal to 0. The off state (logically untrue) is represented by off or the numerical value 0. On or off is returned by a query.

Example:
Setting command: `:SOURce:AM:STATe ON`
Query: `:SOURce:AM:STATe?` Answer: `1`

Text

Text parameters observe the syntax rules for key words, i.e. they can be entered using a short or long form. Like any parameter, they have to be separated from the header by a white space. In the case of a query, the short form of the text is provided.

Example:
Setting command: `:SOURce:SWEep:POWer:MODE MANual`
Query: `:SOURce:SWEep:POWer:MODE?` Answer: `MAN`

Strings

Strings must always be entered within quotation marks (' or ").

Example: `CORR:CSET "UCOR1"` or `:CORR:CSET 'UCOR1'`

Block data

Block data are a transmission format which is suitable for the transmission of large amounts of data. A command using a block data parameter with definite length has the following structure:

Example: `MMEMory:DATA test_file.wv, #45168xxxxxxxx`

Test_file.wv denotes the name of the file to which the data are written. The comma is followed by the binary data block. The hash symbol # introduces the data block. The next number indicates how many of the following digits describe the length of the data block. In the example the 4 following digits indicate the length to be 5168 bytes. The data bytes follow. During the transmission of these data bytes all End or other control signs are ignored until all bytes are transmitted.

The format of the binary files within the block depends on the IEC/IEEE-bus command

`SOURce:CORRection:CSET:DATA:FREQuency|:POWer`

use the IEEE-754 format for double precision floating point numbers. Each number is represented by 8 bytes.

Example:
a# = 125.345678E6

b# = 127.876543E6

```
CALL IBWRT(generator%, "SOURCE:CORRECTION:CSET:DATA:FREQ
#216" + MKD$(a#) + MKD$(b#))
```

- #' in the command string introduces the binary block,
- '2' indicates that 2 digits specifying the length will follow next,
- 16' is the length of the binary block (in bytes), here: 2 double precision floating point number with 8 bytes each.
- The actual binary data follow now. As the function IBWRT requires a text string, MKD$ is used for the type conversion.

The following ASCII format has the same effect:

```
CALL IBWRT(generator%, "SOURce:CORRection:CSET:DATA:FREQ
125.345678E6, 127.876543E6")
```

Overview of Syntax Elements

The following survey offers an overview of the syntax elements.

: The colon separates the key words of a command. In a command line the separating semicolon marks the uppermost command level.

; The semicolon separates two commands of a command line. It does not alter the path.

, The comma separates several parameters of a command.

? The question mark forms a query.

* The asterisk marks a common command.

" Quotation marks introduce a string and terminate it.

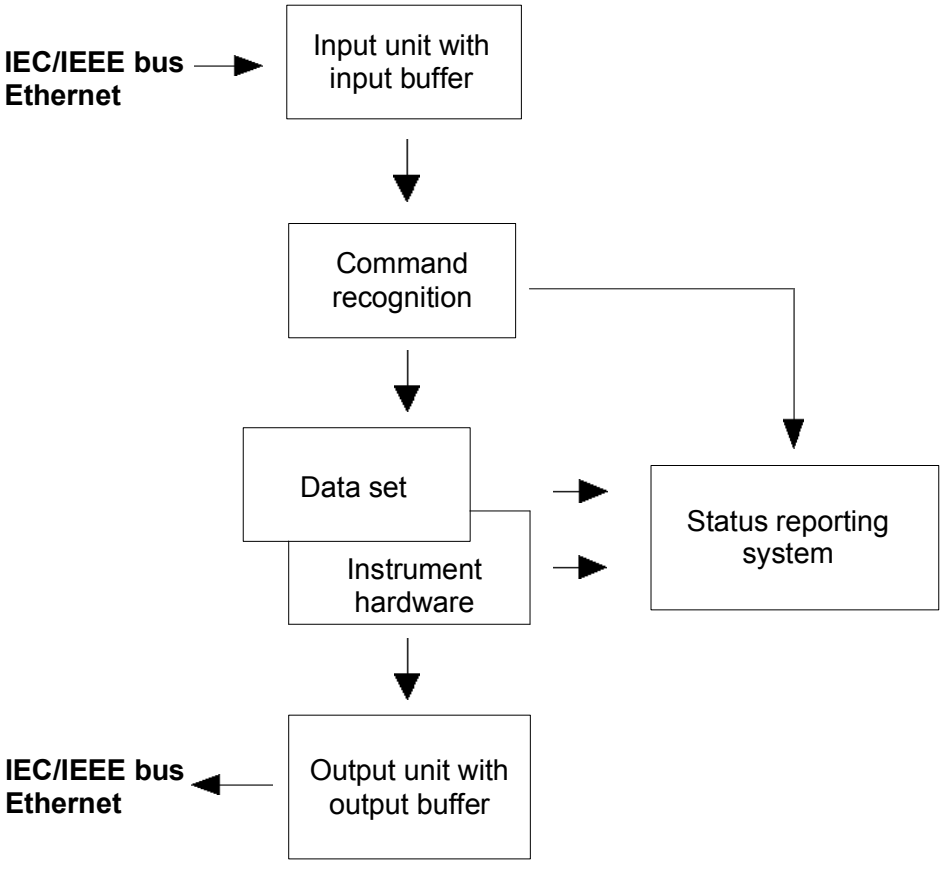
The hash symbol # introduces binary, octal, hexadecimal and block data.

Binary: #B10110
Octal: #O7612
Hexa: #HF3A7
Block: #21312

A "white space" (ASCII-Code 0 to 9, 11 to 32 decimal, e.g. blank) separates header and parameter.

Instrument Model and Command Processing

The block diagram in the figure below shows how SCPI commands are serviced in the instrument. The individual components work independently and simultaneously. They communicate with each other by means of so-called "messages".



Instrument model in the case of remote control via IEC/IEEE bus or TCP/IP network

Input Unit

The input unit receives commands character by character from the IEC/IEEE bus or via the Ethernet and collects them in the input buffer. The input unit sends a message to the command recognition as soon as the input buffer is full or as soon as it receives a delimiter, <PROGRAM MESSAGE TERMINATOR>, as defined in IEEE 488.2, or the interface message DCL.

If the input buffer is full, the ttraffic is stopped and the data received up to then is processed. Subsequently the ttraffic is continued. If, however, the buffer is not yet full when receiving the delimiter, the input unit can already receive the next command during command recognition and execution. The receipt of a DCL clears the input buffer and immediately initiates a message to the command recognition.

Command Recognition

The command recognition analyses the data received from the input unit. It proceeds in the order in which it receives the data. Only a DCL is serviced with priority, a GET (Group Execute Trigger), e.g., is only executed after the commands received before. Each recognized command is immediately transmitted to the data set but not executed immediately.

The command recognition detects syntax errors in the commands and transfers them to the status reporting system. The rest of a command line after a syntax error is analyzed further if possible and serviced. After the syntax test, the value range of the parameter is checked, if required.

If the command recognition detects a delimiter or a DCL, it also requests the data set to perform the necessary instrument hardware settings. Subsequently it is immediately prepared to process further commands. This means that new commands can already be serviced while the hardware is still being set ("overlapping execution").

Database and Instrument Hardware

The expression "instrument hardware" denotes the part of the instrument fulfilling the actual instrument function - signal generation etc. The controller is not included. The term "database" denotes a database that manages all the parameters and associated settings required for setting the instrument hardware.

Setting commands lead to an alteration in the data set. The data set management enters the new values (e.g. frequency) into the data set, however, only passes them on to the hardware when requested by the command recognition. As this is only ever effected at the end of a command line, the order of the setting commands in the command line is not relevant.

The data are only checked for their compatibility among each other and with the instrument hardware immediately before they are transmitted to the instrument hardware. If the detection is made that execution is not possible, an "execution error" is signaled to the status reporting system. All alterations of the data set are canceled, the instrument hardware is not reset. Due to the delayed checking and hardware setting, however, impermissible instrument states can be set for a short period of time within one command line without this leading to an error message. At the end of the command line, however, a permissible instrument state must have been reached again.

Example:

With **Frequency Modulation**, the settable FM deviation depends on the set RF frequency and the FM mode. The Signal Generator responds as follows:

Assuming the set RF frequency is 60 MHz and normal FM mode is set, i.e. the maximum value for FM deviation is 650 kHz. A deviation of 1 MHz should be set. To do so, the RF frequncy has to be changed to e.g. 100 MHz. The following commands are sent:

1. All commands in one program message:

   ```
   :SOUR:FM:STAT ON; :SOUR:FM:DEV 1MHz; :SOUR:FREQ 100MHz
   ```

   This command line yields the desired setting. Since a valid state is obtained at the end of the program message, no error message is issued.

2. Each command in a separate program message:

```
:SOUR:FM:STAT ON

:SOUR:FM:DEV 1MHz

:SOUR:FREQ 100MHz
```

The command for setting the FM deviation is rejected and an execution error is generated. At the time when this command is processed, the previous setting of the RF frequency (60 MHz) is still valid, i.e. the value for the FM deviation is outside the permissible value range. The two other commands are set.

3. The two first commands in one program message, the third command in a separate program message.

```
:SOUR:FM:STAT ON; :SOUR:FM:DEV 1MHz

:SOUR:FREQ 100MHz
```

The command for setting the FM deviation is rejected and an execution error is generated. At the time when this command is processed, the previous setting of the RF frequency (60 MHz) is still valid, i.e. the value for the FM deviation is outside the permissible value range. The two other commands are executed.

This example shows that it is advisable to send interdependent commands in one program message as in this case the sequence in which they are sent is irrelevant.

For further examples on command sequence see section "*Command Sequence and Command Synchronization*", on page 5.21.

Before passing on the data to the hardware, the settling bit in the `STATus:OPERation` register is set (see section *Status Reporting System*, page 5.23). The hardware executes the settings and resets the bit again as soon as the new state has settled. This fact can be used to synchronize command servicing.

Queries induce the data set management to send the desired data to the output unit.

Status Reporting System

The status reporting system collects information on the instrument state and makes it available to the output unit on request. The exact structure and function are described in section "*Status Reporting System*".

Output Unit

The output unit collects the information requested by the controller, which it receives from the data set management. It processes it according to the SCPI rules and makes it available in the output buffer.

If the instrument is addressed as a talker without the output buffer containing data or awaiting data from the data set management, the output unit sends the error message "Query UNTERMINATED" to the status reporting system. No data are sent on the IEC/IEEE bus or via the Ethernet, the controller waits until it has reached its time limit. This behavior is specified by SCPI.

Command Sequence and Command Synchronization

IEEE 488.2 defines a distinction between overlapped and sequential commands:

- An overlapped command is one which does not automatically finish executing before the next command starts executing. Overlapped commands allow the program to do other tasks while being executed.
- A sequential command is one which always finishes before the next command starts executing. Sequential commands are not implemented in the generator, however the execution time of most commands is so short that they act as sequential commands.

If a particular device action can be performed only after the execution of a previous overlapped command, the controller must know when the overlapped command has finished. The necessary interaction between the controller and the test instrument is called command synchronization.

Command Sequence

According to section "*Database and Instrument Hardware*", overlapped execution is possible in principle for all commands of the signal generator. Equally, setting commands within one command line are not necessarily serviced in the order in which they have been received.In order to make sure that commands are actually carried out in a certain order, each command must be sent in a separate command line (see also example in section "*Database and Instrument Hardware*").

Example : Commands and queries in one command line

The response from a query combined in a program message with commands that affect the queried value is not predictable. Sending

```
SOURce:FREQuency 1E+9; LEVel -80
SOURce:FREQuency?
```

always returns 1E+9 (1GHz). When:`SOURce:FREQuency 1E+9; FREQuency?; LEVel -80`

is sent, however, the result is not specified by SCPI. The result could be the RF generator frequency before the command was sent since the instrument might defer executing the individual commands until a program message terminator is received. The result could also be 1GHz if the instrument executes commands as they are received.

As a general rule, send commands and queries in different program messages.

Command Synchronization

In order to prevent an overlapped execution of commands, one of commands *OPC, *OPC? or *WAI can be used. All three commands cause a certain action only to be carried out after the hardware has been set and has settled. By suitable programming, the controller can be forced to wait for the respective action to occur (see table).

Synchronization with `*OPC, *OPC?` and `*WAI`

Command	Action	Programming the controller
*OPC	Sets the Operation Complete bit in the ESR after all previous commands have been executed.	- Setting bit 0 in the ESE - Setting bit 5 in the SRE - Waiting for service request (SRQ)
*OPC?	Stops command processing until 1 is returned. This is only the case after the Operation Complete bit has been set in the ESR. This bit indicates that the previous setting has been completed.	Sending *OPC? directly after the command whose processing should be terminated before other commands can be executed. Disabling bit 4 (MAV) of the SRE register. **Alternative:** Service request or timeout method with enabled MAV bit; see below.
*WAI	Stops further command processing until all commands sent before *WAI have been executed. Note: While waiting it is still possible to send messages to the device.	Sending *WAI directly after the command whose processing should be terminated before other commands are executed.

Command synchronization by means of a *WAI or *OPC? appended to an overlapped command is a good choice if the overlapped command takes only little time to process. The two synchronization techniques simply block overlapped execution of the command.

For time consuming overlapped commands it is usually desirable to allow the controller or the R&S signal generator to do other useful work while waiting for command execution. Use one of the following methods:

***OPC with a service request**

1. Set the OPC mask bit (bit no. 0) in the ESE: *ESE 1
2. Set bit no. 5 in the SRE: *SRE 32 to enable ESB service request.
3. Send the overlapped command with *OPC
4. Wait for a service request

The service request indicates that the overlapped command has finished.

***OPC? with a service request**

1. Set bit no. 4 in the SRE: *SRE 16 to enable MAV service request.
2. Send the overlapped command with *OPC?
3. Wait for a service request

The service request indicates that the overlapped command has finished.

Event Status Register (ESE)

1. Set the OPC mask bit (bit no. 0) in the ESE: *ESE 1
2. Send the overlapped command without *OPC, *OPC? or *WAI
3. Poll the operation complete state periodically (by means of a timer) using the sequence: *OPC; *ESR?

A return value (LSB) of 1 indicates that the overlapped command has finished.

***OPC? with short timeout**

1. Send the overlapped command without *OPC, *OPC? or *WAI
2. Poll the operation complete state periodically (by means of a timer) using the sequence: <short timeout>; *OPC?

A return value (LSB) of 1 indicates that the overlapped command has finished. In case of a timeout, the operation is ongoing.

3. Reset timeout to former value
4. Clear the error queue with SYStem:ERRor? to remove the "-410, Query interrupted" entries.

Status Reporting System

The status reporting system stores information on errors which have occurred. This information is stored in theerror queue. The error queue can be queried via IEC/IEEE bus or via the Ethernet.

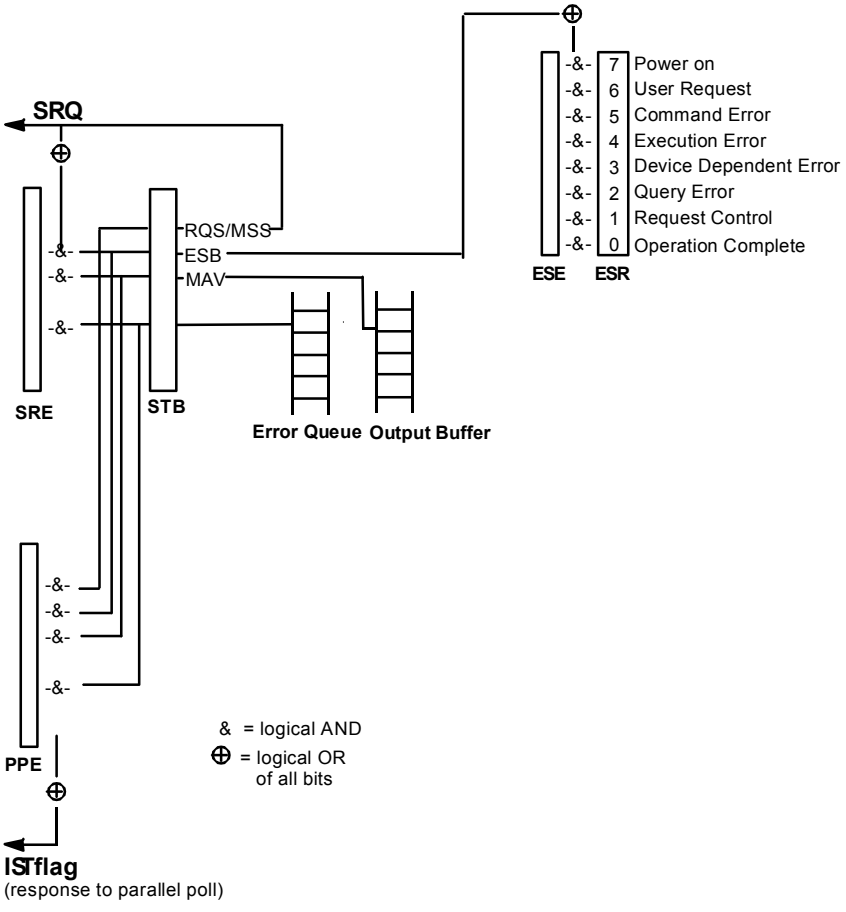
The information is of a hierarchical structure. The register status byte (STB) defined in IEEE 488.2 and its associated mask register service request enable (SRE) form the uppermost level. The STB receives its information from the standard event status register (ESR) which is also defined in IEEE 488.2 with the associated mask register standard event status enable (ESE).

The IST flag ("Individual STatus") and the parallel poll enable register (PPE) allocated to it are also part of the status reporting system. The IST flag, like the SRQ, combines the entire instrument status in a single bit. The PPE fulfills an analog function for the IST flag as the SRE for the service request.

The output buffer contains the messages the instrument returns to the controller. It is not part of the status reporting system but determines the value of the MAV bit in the STB.

Overview of the Status Register

The following figure shows the status registers used in the Signal Generator.



Overview of status registers

Status Byte (STB) and Service Request Enable Register (SRE)

The STB is already defined in IEEE 488.2. It provides a rough overview of the instrument status by collecting the pieces of information of the lower registers A special feature is that bit 6 acts as the sum bit of the remaining bits of the status byte.

The STATUS BYTE is read out using the command "*STB?" or a serial poll.

The STB is linked to the SRE.Each bit of the STB is assigned a bit in the SRE. Bit 6 of the SRE is ignored. If a bit is set in the SRE and the associated bit in the STB changes from 0 to 1, a Service Request (SRQ) is generated on the IEC/IEEE bus or via the Ethernet, which triggers an interrupt in the controller if this is appropriately configured and can be further processed there.

The SRE can be set using command "*SRE" and read using "*SRE?".
Meaning of the bits used in the status byte

Bit no.	Meaning
0...1	Not used
2	**Error Queue not empty** The bit is set when an entry is made in the error queue. If this bit is enabled by the SRE, each entry of the error queue generates a Service Request. Thus an error can be recognized and specified in greater detail by polling the error queue. The poll provides an informative error message. This procedure is to be recommended since it considerably reduces the problems involved with Remote control.
3	Not used
4	**MAV bit** (Message available) The bit is set if a message is available in the output buffer which can be read. This bit can be used to enable data to be automatically read from the instrument to the controller.
5	**ESB bit** Sum bit of the event status register. It is set if one of the bits in the event status register is set and enabled in the event status enable register. Setting of this bit indicates a serious error which can be specified in greater detail by polling the event status register.
6	**MSS bit** (Master-Status-Summary-Bit) The bit is set if the instrument triggers a service request. This is the case if one of the other bits of this register is set together with its mask bit in the service request enable register SRE.
7	Not used

IST-Flag and Parallel Poll Enable Register (PPE)

By analogy with the SRQ, the IST flag combines the entire status information in a single bit. It can be queried by means of a parallel poll (cf. Section "*Parallel Poll*") or using the command "`*IST?`".

The parallel poll enable register (PPE) determines which bits of the STB contribute to the IST flag. The bits of the STB are ANDed with the corresponding bits of the PPE, with bit 6 being used as well in contrast to the SRE. The IST flag results from the ORing of all results. The PPE can be set using commands "*PRE" and read using command "`*PRE?`".

Event Status Register (ESR) and Event Status Enable Register (ESE)

The ESR is defined in IEEE 488.2.The event status register can be read out using command "*ESR?".

The ESE is the associated ENABle part. It can be set using the command "*ESE" and read using the command "*ESE?".

Meaning of the bits used in the event status register

Bit No.	Meaning
0	**Operation Complete** This bit is set on receipt of the command *OPC exactly when all previous commands have been executed.
1	not used
2	**Query Error** This bit is set if either the controller wants to read data from the instrument without having sent a query, or if it does not fetch requested data and sends new instructions to the instrument instead. The cause is often a query which is faulty and hence cannot be executed.
3	**Device-dependent Error** This bit is set if a device-dependent error occurs. An error message with a number between -300 and -399 or a positive error number, which denotes the error in greater detail, is entered into the error queue.
4	**Execution Error** This bit is set if a received command is syntactically correct but cannot be performed for other reasons. An error message with a number between -200 and -300, which denotes the error in greater detail, is entered into the error queue.
5	**Command Error** This bit is set if a command which is undefined or syntactically incorrect is received. An error message with a number between -100 and -200, which denotes the error in greater detail, is entered into the error queue.
6	**User Request** This bit is set on pressing the LOCAL key, i.e., when the instrument is switched over to manual control.
7	**Power On** (supply voltage on) This bit is set on switching on the instrument.

Application of the Status Reporting System

In order to effectively use the status reporting system, the information contained there must be transmitted to the controller and further processed. There are several methods, which are outlined in the following.

Service Request

Under certain circumstances, the instrument can send a service request (SRQ) to the controller. Usually this service request initiates an interrupt at the controller, to which the control program can react appropriately. As evident from section "*Overview of the Status Register*", an SRQ is always initiated if one or several of bits 2, 3, 4, 5 or 7 of the status byte are set and enabled in the SRE. Each of these bits combines the information of the error queue or the output buffer. In order to use the possibilities of the service request effectively, all bits should be set to "1" in the enable registers SRE and ESE.

Example:

Use command "`*OPC`" to generate an SRQ

- `CALL IBWRT(generator%, "*ESE 1")` set bit 0 of ESE (Operation Complete)
- `CALL IBWRT(generator%, "*SRE 32")` set bit 5 of SRE (ESB)

  After its settings have been completed, the instrument generates an SRQ.

The SRQ is the only possibility for the instrument to become active on its own. Each controller program should set the instrument such that a service request is initiated in the case of malfunction. The program should react appropriately to the service request.

Serial Poll

In a serial poll, just as upon the command "`*STB`", the status byte of an instrument is queried. However, the query is made via interface messages and is thus clearly faster. The serial-poll method has already been defined in IEEE 488.1 and used to be the only standard possibility for different instruments to poll the status byte. The method also works for instruments which do not adhere to SCPI or IEEE 488.2.

The VISUAL BASIC command for executing a serial poll is "`IBRSP()`". The serial poll is mainly used to obtain a fast overview of the state of several instruments connected to the IEC/IEEE bus or via the Ethernet .

Parallel Poll

In a parallel poll, the controller uses a single command to request up to eight instruments to transmit one bit of information each on the data lines, i.e., to set the data line allocated to each instrument to a logical "0" or "1". In addition to the SRE register, which determines the conditions under which an SRQ is generated, there is a parallel poll enable register (PPE). This register is ANDed with the STB bit by bit, considering bit 6 as well. The results are ORed, the result is possibly inverted and then sent as a response to the parallel poll of the controller. The result can also be queried without parallel poll by means of the command "`*IST?`".

The instrument first has to be set for the parallel poll using the VISUAL BASIC command "`IBPPC()`". This command allocates a data line to the instrument and determines whether the response is to be inverted. The parallel poll itself is executed using "`IBRPP()`".

The parallel poll method is mainly used to find out quickly which one of the instruments connected to the IEC/IEEE bus has sent a service request. To this effect, SRE and PPE must be set to the same value.

Query by Means of Commands

Each part of any status register can be read by means of queries. The individual commands are listed in the description of the STATus Subsystem. The returned value is always a number that represents the bit pattern of the register queried. This number is evaluated by the controller program.

Queries are usually used after an SRQ in order to obtain more detailed information on the cause of the SRQ.

Error Queue Query

Each error state in the instrument leads to an entry in the error queue. The entries of the error queue are detailed plain-text error messages that can be looked at in the ERROR menu via manual control or queried via the IEC/IEEE bus or via the Ethernet using command `"SYSTem:ERRor?"`. Each call of `"SYSTem:ERRor?"` provides one entry from the error queue. If no error messages are stored there any more, the instrument responds with `0, "No error"`.

The error queue should be queried after every SRQ in the controller program as the entries describe the cause of an error more precisely than the status registers. Especially in the test phase of a controller program the error queue should be queried regularly since faulty commands from the controller to the instrument are recorded there as well.

Reset Values of the Status Reporting Systems

Commands `*RST`, `*DCL` and `SYSTem:PRESet` and switching on the supply voltage also affect the status reporting system. None of the commands, except for `*RST` and `SYSTem:PRESet` influences the functional instrument settings. In particular, DCL does not change the instrument settings.

Resetting the Status Reporting System

Event / Effect	Switching on supply voltage: Power-On-Status-Clear 0	Switching on supply voltage: Power-On-Status-Clear 1	DCL,SDC (Device Clear, Selected Device Clear)	*RST or SYSTem:PRESet	STATus:PRESet	*CLS
Clear STB,ESR	–	yes	–	–	–	yes
Clear SRE,ESE	–	yes	–	–	–	–
Clear PPE	–	yes	–	–	–	–
Clear error-queue	yes	yes	–	–	–	yes
Clear output buffer	yes	yes	yes	1)	1)	1)
Clear command processing and input buffer	yes	yes	yes	–	–	–

1) Every command being the first in a command line, i.e. immediately following a <PROGRAM MESSAGE TERMINATOR> clears the output buffer

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6 Remote Control - Commands

In the following, all remote control commands for the R&S SMC will be presented in detail with their parameters and the ranges of numerical values.

An introduction to remote control and the status registers of the R&S SMC is given in chapter 5, "*Remote Control - Basics*".

Command Description

Notation

All commands implemented in the instrument are first listed in tables and then described in detail, arranged alphabetically according to the command subsystems. The notation is adapted to the SCPI standard. The SCPI conformity information is included in the individual description of the commands.

Table of Commands

Command: In the command column, the table provides an overview of the commands.

Parameter: The parameter column indicates the requested parameters together with their specified range.

Unit: The unit column indicates the basic unit of the physical parameters.

Remark: In the remark column an indication is made on:

- whether the command does not have a query form,
- whether the command has only one query form

Individual description The individual description contains the complete notation of the command. An example for each command, the *RST value and the SCPI information are included as well.

The options that are required to execute the command are listed. In case of dependencies between commands they are also indicated.

Upper/lower case notation Upper/lower case letters are used to mark the long or short form of the key words of a command in the description (see Chapter 5). The instrument itself does not distinguish between upper and lower case letters.

Special characters **|** A selection of key words with an identical effect exists for several commands. These keywords are indicated in the same line; they are separated by a vertical stroke. Only one of these keywords needs to be included in the header of the command. The effect of the command is independent of which of the keywords is used.

Example: `SOURce:FREQuency:CW|:FIXed`

The two following commands with identical meaning can be created. They set the frequency of the fixed frequency signal to 1 kHz

`SOURce:FREQuency:CW 1E3` **=** `SENSe:FREQuency:FIXed 1E3`

A vertical stroke in parameter indications marks alternative possibilities in the sense of "or". The effect of the command is different, depending on which parameter is used.

Example: Selection of the parameters for the command

`SOURce:COUPling AC | DC`

If parameter AC is selected, only the AC content is fed through, in the case of DC, the DC as well as the AC content.

[ ] Key words in square brackets can be omitted when composing the header (cf. Chapter 5, Optional Keywords). The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards.

Parameters in square brackets can be incorporated optionally in the command or omitted as well.

{ } Parameters in braces can be incorporated optionally in the command, either not at all, once or several times..

Description of parameters Due to the standardization, the parameter section of SCPI commands consists always of the same syntactical elements. SCPI has therefore specified a series of definitions, which are used in the tables of commands. In the tables, these established definitions are indicated in angled brackets (<...>) and will be briefly explained in the following (see also Chapter 5, Section "Parameters").

<Boolean> This keyword refers to parameters which can adopt two states, "on" and "off". The "off" state may either be indicated by the keyword OFF or by the numeric value 0, the "on" state is indicated by **ON** or any numeric value other than zero. Parameter queries are always returned the numeric value 0 or 1.

<numeric_value>

<num> These keywords mark parameters which may be entered as numeric values or be set using specific keywords (character data).

The following keywords given below are permitted:

MINimum This keyword sets the parameter to the smallest possible value.

MAXimum This keyword sets the parameter to the largest possible value.

DEFault This keyword is used to reset the parameter to its default value.

UP This keyword increments the parameter value.

DOWN This keyword decrements the parameter value.

The numeric values associated to MAXimum/MINimum/DEFault can be queried by adding the corresponding keywords to the command. They must be entered following the quotation mark.

Example: `SOURce:FREQuency? MAXimum`

eturns the maximum possible numeric value of the center frequency as result.

<arbitrary block program data>

This keyword is provided for commands the parameters of which consist of a binary data block.

Common Commands

The common commands are taken from the standard IEEE 488.2 (IEC 625.2). Identical commands have an identical effect in different instruments. The headers of these commands consist of an asterisk "*" followed by three letters. Many common commands affect the status reporting system, which is described in detail in Chapter 5, "*Remote Control - Basics*".

Command	Parameters	Default unit	Remark
*CLS			Clear status; no query
*ESE	0...255		Event status enable
*ESR?	0...255		Standard event status query; query only
*IDN?			Identification query; query only
*IST?	0...255		Individual status query; query only
*OPC			Operation complete
*OPT?			Option identification query; query only
*PRE	0...255		Parallel poll register enable
*PSC	0 | 1		Power on status clear
*RCL	1...10		Recall
*RST			Reset; no query
*SAV	1...10		Save
*SRE	0...255		Service request enable
*STB?			Status byte query; query only
*TRG			Trigger; no query
*TST?			Self test query; query only
*WAI			Wait to continue; no query

***CLS**

CLEAR STATUS sets the status byte (STB), the standard event register (ESR), and the EVENt part of the QUEStionable and OPERation register to zero. The command does not change the enable and transition parts of the registers. It deletes the output buffer.

***ESE** 0...255

EVENT STATUS ENABLE sets the event status enable register to the specified value. The *ESE? query command returns the content of the event status enable register in decimal form.

***ESR?**

STANDARD EVENT STATUS QUERY returns the content of the event status register in decimal form (0...255) and then sets the register to zero.

***IDN?**

IDENTIFICATION QUERY queries the instrument identification. The instrument type, serial number and firmware version are returned. Example:

Rohde&Schwarz,SMC100A,1411.4002k02/100070,2.02.136 (Release)

***IST?**

INDIVIDUAL STATUS QUERY returns the content of the IST flag in decimal form (0 | 1). The IST flag is the status bit which is sent during a parallel poll.

***OPC**

OPERATION COMPLETE sets bit 0 in the event status register when all previous commands have been processed. This bit can be used to trigger a service request.

***OPC?**

OPERATION COMPLETE QUERY returns a 1 when all previous commands have been processed. It is important to ensure that the timeout set at the IEC/IEEE bus is long enough.

***OPT?**

OPTION IDENTIFICATION QUERY queries the options configured in the instrument and returns a list of the installed options. The options are separated by commas.

***PRE** 0 ... 255

PARALLEL POLL REGISTER ENABLE sets the parallel poll enable register to the specified value. The *PRE? query command returns the content of the parallel poll enable register in decimal form.

***PSC** 0 | 1

POWER ON STATUS CLEAR determines whether the content of the ENABle registers are retained or reset at power on.

Parameters:

0

The content of the status registers is retained at power on. If the status registers ESE and SRE are configured accordingly, this may cause a service request to be triggered at power on.

1

The content of the status registers is reset at power on.

The **query** *PSC? retrieves the contents of the Power-on-Status-Clear flag. The answer is either 0 or 1.

***RCL** <number>

RECALL calls up the instrument status which was stored under the specified number using the `*SAV` command, e.g. `*SAV 4`. It also activates the instrument settings which are stored in a file and loaded using the `MMEMory:LOAD <number>, <file_name.extension>` command.

***RST**

RESET resets the instrument to a defined default state. The command has the same effect as pressing the PRESET key. The default setting is given in the description of the commands.

Functions that concern mainly the integration of the instrument into a measurement setup or are password related are not changed:

- Reference frequency settings
- Power on settings
- Network settings
- IEC/IEEE-bus address
- Password and settings protected by passwords
- Start/Stop Gui Update
- Display settings.
- *IDN? Identification

Note:
Resetting the instrument to the factory state can be performened manually in the Setup menu or with command SYSTem:FPReset.

***SAV** <number>

SAVE stores the current device state under the specified number (see also *RCL). The command is used to store the current instrument state in an intermediate memory. The instrument state can be recalled by using the command *RCL with the associated number.
To transfer the stored instrument settings in a file, command `MMEMory:STORe <number>, <file_name.extension>` is used. Parameter file extension is *.savrcl. Parameter <number> is the specific number defined with the *SAV command, e.g. *SAV 4.

***SRE** 0 ... 255

SERVICE REQUEST ENABLE sets the service request enable register to the specified value. Bit 6 (MSS enable bit) remains 0. This command determines the conditions under which a service request is triggered. The *SRE? query command reads out the content of the service request enable register in decimal form. Bit 6 is always 0.

***STB?**

READ STATUS BYTE QUERY reads out the content of the status byte in decimal form.

***TRG**

TRIGGER triggers all actions which are waiting for a trigger event. Specific trigger events can be triggered by means of the "TRIGger" command system (sweep and lists).

***TST?**

SELF TEST QUERY triggers all self tests of the instrument and outputs an error code in decimal form (see Service Manual supplied with the instrument).

***WAI**

WAIT-to-CONTINUE does not allow subsequent commands to be processed until all previous commands have been executed and all signals are in their transient condition.

CALibration Subsystem

The CALibration system contains the commands for adjustment. Adjustment is triggered by the query commands. The response "0" indicates error-free adjustment, and the response "1" means that an error occurred during adjustment.

Command	Parameters	Default unit	Remark
CALibration:ALL[:MEASure]?			Query only
CALibration:FMOFfset[:MEASure]?			Query only
CALibration:FREQuency[:MEASure]?			Query only
CALibration:LEVel:EXT:DATA	FACTory | CUSTom		
CALibration:LEVel[:MEASure]?			Query only

CALibration:ALL[:MEASure]?

The command starts all internal adjustments for which no external measuring equipment is needed.

The command is a query command and therefore has no *RST value.

Example: `CAL:ALL?`
'starts the adjustment of all functions for the entire instrument.

Response: 0
'adjustment has been performed successfully.

*RST value	Resolution	Options	SCPI
-	-		Compliant

CALibration:FREQuency[:MEASure]?

The command starts all adjustments which affect the frequency.

The command is a query command and therefore has no *RST value.

Example: `CAL:FREQ?`
'starts the adjustments for maximum frequency accuracy.

Response: 0
'the adjustments have been performed successfully.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

CALibration:FMOffset[:MEASure]?

The command starts all adjustment for the FM/PhiM modulator.

The command is a query command and therefore has no *RST value.

Example: `CAL:FMOF?`
'starts the adjustments for the FM/PhiM modulator.

Response: 0
'the adjustments have been performed successfully.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

CALibration:LEVel:EXT:DATA FACTory | CUSTom

Selects the data used for of external level correction.

By default the instrument uses correction data obtained in the factory before delivery. In addition, customer data can be used for external level correction. The customer data is obtained using a R&S NRP power sensor. External level correction is a protected function (see service manual, chapter 2, "Adjustment").

Example: `CAL:LEV:EXT:DATA FACT`
'selects the use of the data aquired at the factory for external level correction.

*RST value	Resolution	Options	SCPI
FACTory	-		Device-specific

CALibration:LEVel[:MEASure]?

Performs all adjustments which affect the level. The aquired correction values improve the settling time and the signal quality.

The command is a query command and therefore has no *RST value.

Example: `CAL:LEV?`
'starts the level adjustment in the mixer range.

Response: 0
'the adjustments have been performed successfully.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DIAGnostic Subsystem

The DIAGnostic system contains the commands used for instrument diagnosis and servicing. SCPI does not define any DIAGnostic commands; the commands listed here are all Device-specific. All DIAGnostic commands are query commands which are not influenced by *RST.

Command	Parameters	Default unit	Remark
DIAGnostic:BGINfo?	<module name>		Query only
DIAGnostic:BGINfo:CATalog?			Query only
DIAGnostic:INFO:OTIMe?			Query only
DIAGnostic:INFO:POCount?			Query only
DIAGnostic:POINt:CATalog?			Query only
DIAGnostic<[1]|2>[:MEASure]:POINt?	<point name>		Query only

DIAGnostic:BGINfo? <module name>

The command checks the modules available in the instrument using the variant and revision state.

If the command is sent without parameters being specified, a complete list of all modules is returned (the various entries are separated by commas). The length of the list is variable and depends on the instrument equipment configuration.

If the command is sent with parameters, a list of the specified modules is returned (the various entries are separated by commas). A list of modules names can be called up using the `DIAG:BGIN:CATalog?` command .

Each entry for one module consists of four parts which are separated by space characters:

Module name Module stock number incl. variant Module revision Module serial number.

Example:

```
DIAG:BGIN:CAT?
```
'queries the instrument configuration .

Response: `MBRD,....`
'returns the data of all available modules.

```
DIAG:BGIN? 'MBRD'
```
'queries the configuration of the motherboard.

Response: `MBRD 1234.5678.02 1.5.3 100023`
'module motherboard with stock number 1234.5678.02 has revision 1.5.3 and serial number 100023.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DIAGnostic:BGINfo:CATalog?

The command queries the names of the assemblies available in the instrument.

A complete list of all assemblies is returned (the various entries are separated by commas). The length of the list is variable and depends on the instrument equipment configuration.

Example: `DIAG:BGIN:CAT?`
'queries the names of the assemblies.

Response: `BABO,RFBO,…`

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DIAGnostic:INFO:OTIMe?

The command queries the number of operation hours

Example: `DIAG:INFO:OTIM?`
'queries the operation hours.

Response: `100023`
'the instrument was operated for 100023 hours up to now.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DIAGnostic:INFO:POCount?

The command queries the number of power-on events.

Example: `DIAG:INFO:POC?`
'queries the number of power on events.

Response: `123`
'the instrument was switched on for 123 times up to now.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DIAGnostic:POINt:CATalog?

The command queries the test points available in the instrument. A detailed description of the test points can be found in chapter 3 , section "Trouble Shooting" of the Service Manual (on CD-ROM, supplied with the instrument).

Example: `DIAG:POIN:CAT?`
'queries the test points available in the instrument.

Response:
`'DIAG_SMC_BAB_P7V,DIAG_SMC_BAB_P5V,DIAG_SMC_BAB_P3V3,…'`

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DIAGnostic[:MEASure]:POINt?

The command triggers voltage measurement at the specified test point and returns the measured voltage. A description of the test points can be found in chapter 3 , section "Trouble Shooting" of the Service Manual (on CD-ROM, supplied with the instrument).

A list of the available test points can be queried using the `DIAG:POIN:CAT?` command .

Example: `DIAG:POIN? 'DIAG_SMC_BAB_P7V'`
'triggers measurement at the test point `DIAG_SMC_BAB_P7V`.

Response: `0.5`
'the voltage at the test point is 0.5 volt.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DISPlay Subsystem

The DISPlay system contains the commands to set the power-save mode of the instrument.

Command	Parameters	Default unit	Remark
DISPlay:PSAVe:HOLDoff	1...60		
DISPlay:PSAVe[:STATe]	ON | OFF		

DISPlay:PSAVe:HOLDoff 1 … 60

This command sets the wait time for the screen-save mode of the display. The available value range is 1 to 60 minutes, the resolution 1 minute. The entry is dimensionless.

Example: `DISP:PSAV:HOLD 10`
''sets the wait for the screen saver mode to 10 minutes.

*RST value	Resolution	Options	SCPI
1	-		Device-specific

DISPlay:PSAVe[:STATe] ON | OFF

This command activates/deactivates the screen-save mode of the display. With the screen-save mode activated the display including backlight is completely switched off after the elapse of the wait time (see command `DISPlay:PSAVe:HOLDoff`) when no entries via front panel, external mouse or external keyboard are made.

This mode is recommended for preserving the display especially if the instrument is exclusively operated via remote control.

Example: `DISP:PSAV ON`
''activates screen saver mode.

*RST value	Resolution	Options	SCPI
OFF	-		Device-specific

FORMat Subsystem

The FORMat subsystem contains the commands which determine the format of the data that the R&S Signal Generator returns to the controller. This affects all query commands which return a list of numerical data or block data. Reference is made to this in the descriptions of the commands.

Command	Parameters	Default unit	Remark
FORMat[:DATA]	ASCii | PACKed		
FORMat:BORDer	NORMal | SWAPped		
FORMat:SREGister	ASCii | BINary | HEXadecimal | OCTal		

FORMat[:DATA] ASCii | PACKed

The command determines the data format which the R&S Signal Generator uses to return data. When data is transferred from the control computer to the instrument, the instrument detects the data format automatically. In this case, the value set here is irrelevant.

Parameters: **ASCii**

'Numerical data is transferred as plain text separated by commas.

PACKed

'Numerical data is transferred as binary block data. The format within the binary data depends on the command. The various binary data formats are explained in the description of the parameter types.

*RST value	Resolution	Options	SCPI
ASCii	-		Compliant

FORMat:BORDer NORMal | SWAPped

The command determines the sequence of bytes within a binary block. This only affects blocks which use the IEEE754 format internally.

Parameters: **NORMal**

'the R&S Signal Generator expects (with setting commands) and sends (with queries) the least significant byte of each IEEE754 floating-point number first, and the most significant byte last.

SWAPped

'the R&S Signal Generator expects (with setting commands) and sends (with queries) the most significant byte of each IEEE754 floating-point number first, and the least significant byte last.

Example: `FORM:BORD SWAP`

'the data is transferred with the most significant bit first.

*RST value	Resolution	Options	SCPI
NORMal	-		Compliant

FORMat:SREGister ASCii | BINary | HEXadecimal | OCTal

The command determines the numerical format which is returned when the status registers are queried.

Parameters:

ASCii
'the register content is returned as a decimal number.

BINary
'the register content is returned as a binary number. #B is placed in front of the number.

HEXadecimal
'the register content is returned as a hexadecimal number. #H is placed in front of the number.

OCTal
'the register content is returned as an octal number. #Q is placed in front of the number.

Example: `FORM:SREG HEX`
'the register content is returned as a hexadecimal number.

*RST value	Resolution	Options	SCPI
ASCii	-		Compliant

MMEMory Subsystem

The MMEMory subsystem (Mass Memory) contains the commands for managing files and directories as well as for loading and storing complete instrument settings in files.

The files are stored on the internal flash memory of the instrument or on external USB memory devices. The /var directory can be used to save user-defined data; any subdirectory structure can be created on /var. Some default subdirectories are predefined and must not be changed.

The default directory is determined using the command `MMEMory:CDIR`.

***Note**:*
The /opt directory is a protected and therefore unaccessable system directory. The files on this directory contain data that must not be changed. Therefore, this directory should not be accessed, since reconstruction of the system partition will lead to data loss.

To enable files in different file systems to be used, the following file naming conventions should be observed:

The file name can be of any length and no distinction is made between uppercase and lowercase letters. The file and the optional file extension are separated by a dot. All letters and numbers are permitted (numbers are, however, not permitted at the beginning of the file name). Where possible, special characters should not be used. Use of the slashes "\" and "/" should be avoided since they are used in file paths. A number of names are reserved by the operating system, e.g. CLOCK$, CON, AUX, COM1...COM4, LPT1...LPT3, NUL and PRN.

In the R&S Signal Generator all files in which lists and settings are stored are given a characteristic extension. The extension is separated from the actual file name by a dot (see the following table containing a list of the file types).

The two characters "*" and "?" function as "wildcards", i.e. they are used for selecting several files. The "?" character represents exactly one character, while the "*" character represents all characters up to the end of the file name. "*.*" therefore stands for all the files in a directory.

When used in conjunction with the commands, the parameter <file_name> is specified as a string parameter with quotation marks. It can contain either the complete path or only the file name. The file name must include the file extension. The same applies for the parameters <directory_name> and <path>. Depending on how much information is provided, either the values specified in the parameter or the values specified with the command `MMEM:CDIR` (default directory) are used for the path setting in the commands.

Before the instrument settings can be stored in a file, they have to be stored in an intermediate memory using common command `*SAV <number>`. The specified number is subsequently used in the `MMEM.STOR:STATe<number>, <file>` command.
Also, subsequently to loading a file with instrument settings with command `MMEM:LOAD:STAT <number>, <file>`, these settings have to be activated with the common command `*RCL <number>`.

In the example below, the current instrument setting is always stored in the file `'test1.ss'` in the directory 'user' on the internal flash memory.

```
*SAV 4
MMEM:STOR:STAT 4,"/var/rs_gen/test1.savrcl"
```

If the complete path is specified, the file is stored in the specified path.

```
MMEM:CDIR  '/var/rs_gen'
*SAV 4
MMEM:STOR:STAT 4,"test1.savrcl"
```

If the parameter only contains the file name, the file is stored in the default directory which was selected with the `MMEM:CDIR` command.

List of file extensions assigned automatically in R&S Signal Generator

List type	Contents	File suffix
Instrument State	Instrument settings	*.savrcl
User Correction	User-defined level correction values	*.uco

Command	Parameters	Default unit	Remark
MMEMory:CATalog?	<path>		Query only
MMEMory:CATalog:LENGth?			Query only
MMEMory:CDIRectory	<directory_name>		No query
MMEMory:COPY	<file_name>,<file_name>		No query
MMEMory:DATA	<file_name>[,<block>]		
MMEMory:DCATalog?			Query only
MMEMory:DCATalog:LENGth?			Query only
MMEMory:DELete	<file_name>		No query

MMEMory:LOAD:STATe	<number>,<file_name>		No query
MMEMory:MDIRectory	<directory_name>		No query
MMEMory:MOVE	<file_name>,<file_name>		No query
MMEMory:MSIS	<msus>		
MMEMory:RDIRectory	<directory_name>		
MMEMory:STORe:STATe	<number>,<file_name>		

MMEMory:CATalog? <path>

This command reads out the subdirectories and files in the specified directory. If no directory is specified, the default directory selected with the `MMEM:CDIR` command is read out.

The response has the following format:

```
<used_bytes_in_this_directory>,<free_bytes_on_this_disk>,
<file_name>,<file_type>,<filesize_in_bytes>,
<file_name>,<file_type>,<filesize_in_bytes>, …
```

The command is a query command and therefore has no *RST value.

Parameters:

<file_name>
File or directory name

<file_type>
File type. There are the following file types: DIR (directory), ASCii (ASCII file), BINary (Binary file), and STATe (file with instrument settings).

<filesize_in_bytes>
File size. The size "0" is returned for a directory.

Example: `MMEM:CAT? '/var'`
'reads out all files at the highest directory level of the flash memory.

Response:

"'127145265,175325184,"test,DIR,0","temp,DIR,0","readme.txt,ASC,1324","state.savracl,STAT,5327","waveform.wv,BIN,2342"

'the directory `var/` contains the subdirectories `'test'` and `'temp'` as well as the files `'readme.txt'`, `'state.savrcl'` and `'waveform.wv'` which have different file types.

*RST value	Resolution	Options	SCPI
-	-		Compliant

MMEMory:CATalog:LENGth? <path>

This command reads out the number of files in the specified directory. If no directory is specified, the default directory selected with the `MMEM:CDIR` command is read out.

The command is a query command and therefore has no *RST value.

Example: `MMEM:CAT:LENG? 'var/'`
'reads out the number of files at the highest directory level of the flash memory.

Response: 1
'there is 1 file at the highest directory level of the memory stick.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

MMEMory:CDIRectory <directory_name>

This command changes the default directory. This directory is used for all subsequent MMEM commands if no path is specified with them. It is also possible to change to a higher directory using two dots '..' .

Example: `MMEM:CDIR 'test'`
'changes from the current directory level to the subdirectory `'test'`.

*RST value	Resolution	Options	SCPI
/Var	-		Compliant

MMEMory:COPY <source>[,<destination>]

This command copies the first specified file to the second specified file. Instead of just a file, this command can also be used to copy a complete directory together with all its files.

If <destination> is not specified, <source> is copied to the `MMEM:CDIR` directory. Files which already exist with the same name in the destination directory are overwritten without an error message.

It is also possible to specify the path using another parameter. The command is:
MMEMory:COPY <file_source><msus_source>[,<file_destination>,<msus_destination>]

The command triggers an event and therefore has no query form and no *RST value.

Example: `MMEM:COPY 'var/rs_gen/test1.savrcl,'var/temp'`
'copies the file `'test1.savrcl'` in the USER directory on the internal flash memory to the TEMP directory without changing the file name.

*RST value	Resolution	Options	SCPI
-	-		Compliant

MMEMory:DATA <file_name>[,<binary block data>]
MMEMory:DATA? <file_name>

This command writes the block data <binary block data> to the file identified by <file_name>. The IEC/IEEE-bus terminator should be set to EOI in order to ensure correct data transfer.

The associated query command transfers the specified file from the R&S Signal Generator to the IEC/IEEE bus and then on to the control computer. It is important to ensure that the intermediate memory on the control computer is large enough to take the file. In this case, the setting for the IEC/IEEE-bus terminator is irrelevant.

This command can be used to read/transfer stored instrument settings directly from/to the instrument.

The binary data block has the following structure: #234<block_data>
always comes first in the binary block
<number> indicates how many digits the subsequent length entry has (2 in example)
<number> indicates the number of subsequent bytes (34 in example)
<binary block data> binary block data for the specified length

Example: `MMEM:DATA 'TEST1.savrcl',#3767<binary data>`
'writes the block data to the file `'test1.savrcl'`.

`MMEM:DATA? 'TEST1.SAVRCL'`
'sends the data of the file `'Test1.savrcl'` from the R&S Signal Generator to the control computer in the form of a binary block.

*RST value	Resolution	Options	SCPI
-	-		Compliant

MMEMory:DCATalog? <path>

This command reads out the subdirectories of the specified directory. If no directory is specified, the default directory selected with the `MMEM:CDIR` command is read out. The directories are output in a list (the list entries are separated by commas).

The command is a query command and therefore has no *RST value.

Example: `MMEM:DCAT?`
'reads out the subdirectories of the current directory.

Response: 'test', 'wave', 'digital'
'the subdirectories 'test', 'wave' and 'digital' exist in the current directory.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

MMEMory:DCATalog:LENGth? <path>

This command reads out the number of subdirectories in the specified directory. If no directory is specified, the directory selected with the `MMEM:CDIR` command is read out.

Example: `MMEM:DCAT:LENG`
'reads out the number of subdirectories in the current directory.

Response: 3
'there are 3 subdirectories in the current directory.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

MMEMory:DELete <file_name>

This command deletes the specified file.

The command triggers an event and therefore has no query form and no *RST value.

Example: `MMEM:DEL 'var/rs_gen/TEST1.SAVRCL'`
'deletes the file `'Test1.savrcl'` in the USER directory on the internal flash memory.

*RST value	Resolution	Options	SCPI
-	-		Compliant

MMEMory:LOAD:STATe 4,<file_name>

This command loads the specified file stored under the specified name in an internal memory.

The instrument setting must be activated using an *RCL command with the number used after the file has been loaded (see the section "*Common Commands*", page 6.4).

Example: `"*SAV 4"`
'stores the current instrument setting in an intermediate memory with number 4.

`"MMEM:STOR:STAT 4,'VAR/USER/test4.savrcl'"`
'stores the instrument setting stored with the *SAV command under memory number 4 in the file `'test1.ss'` in the USER directory on the internal flash memory.

`"MMEM:LOAD:STAT 4,'VAR/USER/test4.savrcl'"`
'loads the file `'Test4.savrcl'` in the USER directory of the internal flah memory.

`"*RCL 4"`
'activates the instrument setting of the file `'Test4.savrcl'`.

*RST value	Resolution	SCPI
-	-	Compliant

MMEMory:MDIRectory <directory_name>

The command creates a new subdirectory in the specified directory. If no directory is specified, a subdirectory is created in the default directory. This command can also be used to create a directory tree.

The command triggers an event and therefore has no query form and no *RST value.

Example: `MMEM:MDIR 'carrier'`
'creates the subdirectory `'carrier'` in the current directory.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

MMEMory:MOVE <file_source>,<file_destination>

This command renames an existing file if no path is specified for <file_destination>. Otherwise the file is moved to the specified path and stored under the original file name or, if specified, a new file name.
It is also possible to specify the path using another parameter. The command is:
MMEMory:MOVE <file_source><msus_source>[,<file_destination>,<msus_destination>]

The command triggers an event and therefore has no query form and no *RST value.

Example: `MMEM:MOVE 'test1.savrcl','keep1.savrcl`
'renames the file `'test1.savrcls'` as `'keep1.savrcl'`.

`MMEM:MOVE 'test1.savrcl','\smc_one\keep1.savrcl`
'moves the file `'test1.savrcl'` to the subdirectory `'smc_one'` and stores it there under the name `'keep1.savrcl'`.

*RST value	Resolution	Options	SCPI
-	-		Compliant

MMEMory:MSIS <msus>

The command is without effect for the Linux operating system of R&S SMC.

*RST value	Resolution	Options	SCPI
-	-		Compliant

MMEMory:RDIRectory <directory_name>

The command deletes the specified subdirectory in the specified directory. If no directory is specified, the subdirectory with the specified name is deleted in the default directory.
The command triggers an event and therefore has no query form and no *RST value.

Example: `MMEM:RDIR 'carrier'`
'deletes the subdirectory 'carrier' in the current directory.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

MMEMory:STORe:STATe 4,<file_name>

This command stores the current instrument setting in the specified file. The instrument setting must first be stored in an internal memory with the same number using the common command *SAV.
The command triggers an event and therefore has no query form and no *RST value.

Example: `"*SAV 4"`
'stores the current instrument setting in an intermediate memory with number 4.

`MMEM:STOR:STAT 4,'VAR/RS_GEN/TEST1.savrcl'`
'stores the current instrument setting in the file `'test1.savrcl'` in the USER directory on the internal flash memory.

*RST value	Resolution	Options	SCPI
-	-		Compliant

OUTPut Subsystem

The OUTPut system contains the commands which set the properties of the RF output connector. The properties of the LF output connector are set in the SOURce:LFOutput system, see section "*SOURce:LFOutput Subsystem*".

Command	Parameters	Default unit	Remark
OUTPut:AFIXed:RANGe:LOWer?		dBm	Query only
OUTPut:AFIXed:RANGe:UPPer?		dBm	Query only
OUTPut:AMODe	AUTO | FIXed		
OUTPut:BLANk:LIST:STATe	ON | OFF		
OUTPut:IMPedance		Ohm	Query only
OUTPut:PROTection:CLEar			No query
OUTPut:PROTection:TRIPped			Query only
OUTPut[:STATe]	ON | OFF		
OUTPut[:STATe]:PON	OFF | UNCHanged		

OUTPut:AMODe AUTO | NORMal

The command switches the mode of the attenuator at the RF output (Attenuator MODe).

Parameters:

AUTO
The attenuator is switched automatically. The level settings are made in the full range..

FIXed
The level settings are made without switching the attenuator. When this operating mode is switched on, the attenuator is fixed in its current position and the resulting variation range is defined.

Example:

```
POW:ALC ON
```
'activates automatic level control for RF output.

```
OUTP:AMOD FIX
```
'sets the fixed mode with uninterrupted level for the RF output'.

*RST value	Resolution	Options	SCPI
AUTO	-		Device-specific

OUTPut:AFIXed:RANGe:LOWer?

The command queries the minimum level which can be set without the attenuator being adjusted (Attenuator FIXed).

The command is a query and therefore has no *RST value.

Example: OUTP:AFIX:RANG:LOW?
'queries the minimum level for the FIXed setting'.

Response:
'-50' 'the minimum level is -50 dBm.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

OUTPut:AFIXed:RANGe:UPPer?

The command queries the maximum level which can be set without the attenuator being adjusted (Attenuator FIXed).

The command is a query and therefore has no *RST value.

Example: OUTP:AFIX:RANG:UPP?
'queries the maximum level for the FIXed setting for the RF output'.

Response:-27
'the maximum level is -27 dBm.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

OUTPut:IMPedance

The command queries the impedance of the RF output. This permits converting the output level between units V and W. The impedances cannot be changed.

The command is a query and therefore has no *RST value.

Example: OUTP:IMP?
'queries the impedance of the RF output.

Response: 50'the impedance is 50 ohms

*RST value	Resolution	Options	SCPI
-	-		Compliant

OUTPut - Blank RF Output

OUTPut:BLANk:LIST:STATe ON |OFF

The command activates/deactivates RF output blanking.

The command is a query and therefore has no *RST value.

Example: ":OUTP:BLAN:LIST:STAT ON
'activates the RF output blanking.

*RST value	Resolution	SCPI
ON	-	Device-specific

OUTPut - Protection ClearOUTPut<[1]|2>:PROTection:CLEar

The command resets the protective circuit after it has been tripped. The state of the output is again determined by OUTPut:STATe. .

The output is protected by a protective circuit which deactivates the output in the case of an externally applied overvoltage This does not change the value of OUTPut:STATe.

Example: OUTP:PROT:CLE" 'resets the protective circuit for the RF output.

*RST value	Resolution	Options	SCPI
-	-		Compliant

OUTPut - ProtectionOUTPut:PROTection:TRIPped

The command queries the state of the protective circuit.

The command triggers an event and therefore has no reset value.

Example: "OUTP:PROT:TRIP?" 'queries the state of the protective circuit for RF output A.

Response:"0" 'the protective circuit has not tripped.

Response:"1" 'the protective circuit has tripped.

*RST value	Resolution	Options	SCPI
-	-		Compliant

OUTPut[:STATe] ON | OFF

This command activates and deactivates the RF output.

Example: OUTP OFF
'deactivates the RF output.

*RST value	Resolution	Options	SCPI
-	-		Compliant

OUTPut[:STATe]:PON OFF | UNCHanged

This command selects the state which the RF output assumes when the instrument is switched on.

The command is an event and therefore has no *RST value and no query form.

Parameters: **OFF**
The output is deactivated when the instrument is switched on.

UNCHanged
When the instrument is switched on, the output remains in the same state as it was when the instrument was switched off.

Example: `OUTP:PON OFF`
'The RF output is deactivated when the instrument is switched on.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SENSe, INITiate and READ Subsystem

The SENSe subsystem contains the commands for configuring the power measurements with a R&S NRP power sensor connected to the generator. The measurement is started and the measurement result retrieved with the READ command. The description of this commands is included in the following.

Command	Parameters	Default unit	Remark
INITiate[:POWer]:CONTinuous	ON | OFF		
READ[:POWer]?			Query only
SENSe[:POWer]:CORRection:SPDevice:STATe	ON | OFF		
SENSe[:POWer]:DISPlay:PERManent:STATe	ON | OFF		
SENSe[:POWer]:FILTer:LENGth:AUTO?			Query only
SENSe[:POWer]:FILTer:LENGth[:USER]	1 …65536		
SENSe[:POWer]:FILTer:NSRatio	0.0001 … 1.0		
SENSe[:POWer]:FILTer:NSRatio.MTIMe	1.0 … 999.99	s	
SENSe[:POWer]:FILTer:SONCe			No query
SENSe[:POWer]:FILTer:TYPE	AUTO | USER | NSRatio		
SENSe[:POWer]:FREQuency	<frequency>	Hz	Range depends on used sensor
SENSe[:POWer]:OFFSet	-100 … 100 dB	dB	
SENSe[:POWer]:OFFSet:STATe	OFF | ON		
SENSe[:POWer]:SNUMber?			Query only
SENSe[:POWer]:SOURce	A | USER		
SENSe[:POWer]:STATus[:DEVice]?			Query only
SENSe[:POWer]:SVERsion?			Query only
SENSe[:POWer]:TYPE?			Query only
SENSe[:POWer]:ZERO			No Query
SENSe:UNIT[:POWer]	DBM | DBUV | WATT	DBM	

INITiate[POWer]:CONTinuous ON | OFF

The command switches the local state of the continuous power measurement by the R&S NRP-Zxx power sensors on and off. Switching the local state off enhances the measurement performance during remote control

Example: `INIT:CONT ON`
'switches local state of continuous power measurement on.

*RST value	Resolution	SCPI
OFF	-	Device specific

READ[:POWer]?

The command triggers the measurement with power sensors and provides the power measurement result of the selected power sensor. The value is provided with the unit set with command `SENSe:UNIT[:POWer]`.

For certain power sensors, e.g. R&S NRP-Z81, two values are returned, first the value for the average level and - separated by a comma - the peak level.

Note:
The local state is not influenced by this commands, measurements results can be retrieved with local state on or off. For long measurement times it is recommended to use a SRQ (MAV bit) for command synchronization.

The command is a query command and therefore has no *RST value.

Example: `SENS:UNIT DBM`
'selects unit dBm for presentation of measurement result.

`READ?`
'queries the measurement result of the sensor.

Response: `-45.6246576745440230`
'-45.6 dBm were measured at the given frequency.

or (e.g. for R&S NRP-Z81)

Response: `-55.62403263352178,-22.419472478812476`
'-55,6 dbm is the measured average level, -22. 4 dBm is the measured peak level at the given frequency

*RST value	Resolution	SCPI
-	-	Device specific

SENSe[:POWer]:CORRection:SPDevice:STATe ON | OFF

The command activates the use of the s-parameters correction data of the power sensor.

Example: `SENS:CORR:SPD:STAT ON`
'activates the use of the s-parameters correction data of the power sensor.

*RST value	Resolution	Dependencies	SCPI
OFF	-	For power sensor with attenuator this command is automatically set to ON.	Device specific

SENSe[:POWer]:DISPlay:PERManent:STATe ON | OFFFF

The command switches on and off the permanent indication of the power measurement result in the upper right corner of the block diagram. The type of sensor, the connector, the measurement source and - if set - the offset is indicated.

Example: `SENS:POW:DISP:PERM:STAT ON`
'the permanent viewer is switched on.

*RST value	Resolution	SCPI
OFF	-	-

SENSe[:POWer]:FILTer:LENGth:AUTO?

The command queries the current filter length for auto filter mode (`:SENSe:POWer:FILTer:TYPE AUTO`)

The command is a query command and therefore has no *RST value.

Example: `SENS:FILT:TYPE AUTO`
'selects auto filter mode for the power sensor connected to the SENSOR connector.

`SENS:FILT:LENG:AUTO?`
'queries the automatically set filter length.

Response: `1024`

*RST value	Resolution	SCPI
	-	Device specific

SENSe[:POWer]:FILTer:LENGth[:USER] 1 … 65536

The command selects the filter length for user filter mode (`SENSe:POWer:FILTer:TYPE USER`). As the filter length works as a multiplier for the time window, a constant filter length results in a constant measurement time. Values 1 and 2^n are setable.

The time window is fixed to 20 ms.

Example: `SENS:FILT:TYPE USER`
'selects user filter mode.

`SENS:FILT:LENG 16`
'sets a filter length of 16. The resulting measurement time is 640 ms (2x16x20 ms).

*RST value	Resolution	SCPI
1	-	Device specific

SENSe[:POWer]:FILTer:NSRatio 0.0001 … 1.0

The command defines the noise content for fixed noise filter mode (`:SENSe:POWer:FILTer:TYPE SNRation`).

Example:
```
SENS:FILT:TYPE SNR
```
'selects fixed noise filter mode for the power sensor.
```
SENS:FILT:NSR 0.2
```
'sets a noise content of 0.2.

*RST value	Resolution	SCPI
0.001	-	Device specific

SENSe[:POWer]:FILTer:NSRatio:MTIMe 1.0 … 999.99 s

The command defines the timeout for fixed noise filter mode (`:SENSe:POWer:FILTer:TYPE SNRation`). This value ensures limited settling times.

Example:
```
SENS:FILT:TYPE SNR
```
'selects fixed noise filter mode for the power sensor.
```
SENS:FILT:NSR 0.2
```
'sets a noise content of 0.2.
```
SENS:FILT:NSR:MTIM 5
```
'limits the settling time to 5 seconds

*RST value	Resolution	SCPI
4 s	-	Device specific

SENSe[:POWer]:FILTer:SONCe

The command activates the search for the optimum filter length for the current measurement conditions. The found filter length can be retrieved with command `SENSe:POWer:FILTer:LENGth:USER?`. This command is only available for user filter mode (`SENSe:POWer:FILTer:TYPE USER`).

The command triggers an event and therefore has no *RST value and no query form.

Example:
```
SENS:FILT:TYPE USER
```
'selects user filter mode.
```
SENS:FILT:SONC
```
'activates the search for the optimum filter length for the current measurement conditions.
```
SENS:FILT:LENG?
```
'returns the found optimum filter length.

Response: `128`

*RST value	Resolution	SCPI
-	-	Device specific

SENSe[:POWer]:FILTer:TYPE AUTO | USER | NSRatio

The command selects the filter mode. The filter length is the multiplier for the time window and thus directly influences the measurement time.

Parameters:

AUTO

The filter length is automatically selected and adapted to the currently measured value. With very high signals the filter length and therefore the measurement time can be short. With very low signal levels the filter length and therefore the measurement time is increased in order to reduce noise. The used filter length is quereid with command `SENSe:FILTer:LENGth:AUTO`.

USER

The filter length is set manually with command `SENSe:FILTer:LENGth:USER`. As the filter length works as a multiplier for the measurement time, this results in a constant measurement time.

SNRatio

The filter length (averaging factor) is automatically selected so that sensor's intrinsic noise (2 standard deviations) does not exceed the specified noise content. The desired noise content is set with command `SENSe:FILTer:NSRatio.`

To avoid very long settling times when the power is low, the averaging factor can be limited with the **Timeout** parameter (command `SENSe:FILTer:NSRatio:MTIMe)` .

Example:

```
SENS:FILT:TYPE AUTO
```

'selects automatic filter selection.

*RST value	Resolution	SCPI
AUTO	-	Device specific

SENSe[:POWer]:FREQuency <frequency>

The command sets the RF frequency of the source if the user source is selected (`SENSe[:POWer]:SOURce USER`.

Example:

```
SENS:SOUR USER
```

'selects user-defined source.

```
SENS:FREQ 2.44 GHz"
```

'enters the RF frequency of the source which is 2.44 GHz.

*RST value	Resolution	SCPI
1 GHz	-	Device specific

SENSe[:POWer]:Offset -100 … 100

The command enters a level offset which is added to the measured level value after activation with command `SENSe[:POWer]:Offset:STATe ON`. This allows e.g. an attenuator in the signal path to be taken into account.

Example: `SENS:POW:OFFS 10.0`
'sets a level offset of 10 dB

*RST value	Resolution	SCPI
0.0 dB	-	-

SENSe[:POWer]:Offset:STATe ON | OFF

The command activates the addition of the level offset to the measured value. The level offset value is set with command `SENSe[:POWer]:Offset`.

Example: `SENS:POW:OFFS 0.4dB`
'sets a level offset of 0.4 dB

`SENS:POW:OFFS:STAT ON`
'a level offset of 0.4 dB is added to the measured value.

*RST value	Resolution	SCPI
OFF	-	-

SENSe[:POWer]:SNUMber?

The command queries the serial number of the sensor.

The command is a query command and therefore has no *RST value.

Example: `"SENS:SNUM?"`
'queries the serial number.

*RST value	Resolution	SCPI
-	-	Device specific

SENSe[:POWer]:SOURce A | USER

The command selects the signal source for the measurement. The RF signal (A) or a user defined source can be selected. The frequency of the user-defined source has to be entered with command `SENSe:POWer:FREQuency`.

Example: `SENS:SOUR A`
'selects the RF signal as measurement source. The RF frequency is used as the measurement frequency of the sensor and the corresponding correction factor is used. The level setting of the instrument serves as reference level of the measurement.

*RST value	Resolution	SCPI
A	-	Device specific

SENSe[:POWer]:STATus[:DEVice]?

The command queries if a sensor is connected to the signal generator.

The command is a query command and therefore has no *RST value.

Example: SENS:STAT?
'queries if a sensor is connected.

Response: 1
'a sensor is connected.

*RST value	Resolution	SCPI
-	-	Device specific

SENSe[:POWer]:SVERsion?

The command queries the software version of the connected R&S NRP power sensor.

The command is a query command and therefore has no *RST value.

Example: SENS:POW:SVER?
'queries the software version of the R&S NRP power sensor.

*RST value	Resolution	SCPI
-	-	-

SENSe[:POWer]:TYPE?

The command queries the type of sensor . The type is automatically detected.

The command is a query command and therefore has no *RST value.

Example: "SENS:TYPE?"
'queries the type of sensor.

Response: NRP-Z21
'the R&S NRP-Z21 sensor is used.

*RST value	Resolution	SCPI
-	-	Device specific

SENSe[:POWer]:ZERO

The command activates the autozero function. Zeroing is required in regular interval (at least once a day)and if the temperature has varied more than about 5 °C, if the sensor has been replaced or if measurements of signals with very low power are to be performed. The sensor must be disconnected from all power sources before starting the autozero function.

The command is an event and therefore has no *RST value.

Example: SENS:ZERO
'activates autozero function.

*RST value	Resolution	SCPI
-	-	Device specific

SENSe:UNIT[:POWer] DBM | DBUV | WATT

The command selects the unit used for result query with command READ. The power sensor provides the measured value in Watt. In which unit the measured value is returned is selected here and might be either Watt, dBm or dBuV.

Example: `"SENS:UNIT DBM"`
'selects unit dBm for the measured value returned by command READ.

`READ?`

Response: `7.34`
'7.34 dBm are measured by the sensor.

*RST value	Resolution	SCPI
DBM	-	Device specific

SOURce Subsystem

The SOURce subsystem contains the commands for configuring the generated signals. The keyword SOURce is optional and can be ommitted.

SOURce:AM Subsystem

The AM subsystem contains the commands for checking the amplitude modulation. The AM-specific characteristics of the internal modulation source are defined with commands SOURce:AM:INTernal:... Characteristics which are valid for all modulations and the LF Output are configured in the SOURce:LFOutput subsystem. The external signal is input at the **MOD EXT** connector.

The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]AM[:DEPTh]	0...100 PCT	PCT	
[SOURce:]AM:EXTernal:COUPling	AC | DC		
[SOURce:]AM:SENSitivity?			Query only
[SOURce:]AM:SOURce	EXT | INT		
[SOURce:]AM:STATe	ON | OFF		

[SOURce:]AM[:DEPTh] 0 ... 100 PCT

The command sets the overall modulation depth of the amplitude modulation in percent.

Example: `AM 15PCT`
'sets the AM modulation depth to 15 percent.

*RST value	Resolution	Options	SCPI
30 PCT	See data sheet		Compliant

[SOURce:]AM:EXTernal:COUPling AC | DC

The command selects the coupling mode for the external modulation input (MOD EXT) in the case of amplitude modulation.

Parameters:

AC
The DC voltage component is disconnected from the modulation signal.

DC
The modulation signal is not changed.

Example: `AM:EXT:COUP AC`
'selects the coupling mode AC for external amplitude modulation

*RST value	Resolution	Options	SCPI
AC	-		Compliant

[SOURce:]AM:SENSitivity?

The command queries the input sensitivity of the MOD EXT input in %/V. The command is only effective if the external modulation source is selected (`SOUR:AM:SOUR EXT`). The returned value depends on the modulation depth setting (`SOUR:AM:DEPTh`). This value is assigned to the voltage value for full modulation of the input.

The command is a query command and therefore has no *RST value.

Example: `AM:DEPT 50`
'sets a modulation depth of 50 %.

`AM:SENS?`
'queries the input sensitivity at the MOD EXT input.

Response: `50`
'since the voltage value for full modulation is 1V, the resulting sensitivity is precisely 50%/V.

*RST value	Resolution	Options	SCPI
-	-		Compliant

[SOURce:]AM:SOURce EXT | INT

The command selects the modulation source for amplitude modulation. INT is the internal modulation source and is configured in the SOURce:LFOutput subsystem. The external signal is input at the **MOD EXT** connector.

Example: `AM:SOUR INT`
'selects the internal modulation source.

*RST value	Resolution	Options	SCPI
INTernal	-		Compliant

[SOURce:]AM:STATe ON | OFF

The command activates/deactivates amplitude modulation.

Example: `AM:STAT ON`
'activates AM modulation.

*RST value	Resolution	Options	SCPI
OFF	-		Compliant

SOURce:CORRection Subsystem

The output level is corrected in the CORRection subsystem. Correction is performed by user-defined table values being added to the output level for the respective RF frequency . In the R&S Signal Generator, this subsystem is used to select, transfer and activate user correction tables (see also chapter 4).

Each list is stored as a file. The name of the user correction file can be freely selected. The file extension ***.uco** is assigned automatically and cannot be changed.

The files can be stored in a freely selectable directory and opened from there. The default directory is set using command `MMEMory:CDIRectory`. In the case of files which are stored in the default directory, only the file name has to be specified in commands. Otherwise, the complete absolute path has to be specified with every command. The extension can be omitted in any case.

The amplitude can also be linearized automatically by means of a R&S NRP power sensor connected to the generator output signal. With the aid of the `SOURce:CORRection:CSET:DATA:POWER:SONCe` command, a list with correction values for external test assemblies can be automatically determined, e.g. for compensating the frequency response of cables. The correction values can be acquired any time irrespective of the modulation settings of the generator.

Note:
In the following command examples, the files are stored in the default directory.

The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]CORRection:CSET:CATalog?	-		Query only
[SOURce:]CORRection:CSET:DATA:FREQuency	300 kHz...RF_{max} {,300 kHz...RF_{max} }	HZ	
[SOURce:]CORRection:CSET:DATA:FREQuency:POINts?			Query only
[SOURce:]CORRection:CSET:DATA:POWer	-40 dB...6dB {,-40 dB...6 dB}	dB	
[SOURce:]CORRection:CSET:DATA:POWer:POINts?			Query only
[:SOURce:CORRection:CSET:DATA[:SENSor][:POWer]:SONCe			No query
[SOURce:]CORRection:CSET:DELete	<table name>		No query
[SOURce:]CORRection:DEXChange:AFILe:CATalog?			Query only
[SOURce:]CORRection:DEXChange:AFILe:EXTension	TXT | CSV		
[SOURce:]CORRection:DEXChange:AFILe:SELect	<ASCII file name>		
[SOURce:]CORRection:DEXChange:AFILe:SEParator:COLumn	TABulator | SEMicolon | COMMa | SPACe		
[SOURce:]CORRection:DEXChange:AFILe:SEParator:DECimal	DOT | COMMa		
[SOURce:]CORRection:DEXChange:EXECute			No query
[SOURce:]CORRection:DEXChange:MODE	IMPort | EXPort		
[SOURce:]CORRection:DEXChange:SELect	<ucor file>		
[SOURce:]CORRection:CSET[:SELect]	<table name>		
[SOURce:]CORRection[:STATe]	ON | OFF		
[SOURce:]CORRection:VALue		dB	Query only

[SOURce:]CORRection:CSET:CATalog?

The command requests a list of user correction tables. The individual lists are separated by commas.

The lists are stored with the fixed file extensions ***.uco** in a directory of the user's choice. The directory applicable to the commands is defined with the command `MMEMory:CDIR`.

This command is a query command and has no *RST value.

Example: `MMEM:CDIR 'var/lists/ucor'`
'selects the directory for the user correction files.

`CORR:CSET:CAT?`
'queries which correction tables are available.

Response: `UCOR1,UCOR2,UCOR3`
'the correction tables `UCOR1`, `UCOR2` and `UCOR3` are available.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]CORRection:CSET:DATA:FREQuency 300 kHz...RF_{max} {,300 kHz...RF_{max}}

The command transfers the frequency data to the table selected with `:CORR:CSET:SEL`.

*RST does not affect data lists.

Example: `CORR:CSET 'var/lists/ucor/ucor1'`
'selects the table `ucor1`.

`CORR:CSET:DATA:FREQ 100MHz,102MHz,103MHz,...`
'enters the frequency value in the table UCOR1.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]CORRection:CSET:DATA:FREQuency:POINts?

The command queries the number of frequency values in the selected table.

The command is a query command and therefore has no *RST value.

Example: `CORR:CSET 'var/lists/ucor/ucor1'`
'selects the table `ucor1`.

`CORR:CSET:DATA:FREQ:POIN?`
'queries the number of frequency values in the table `ucor1`.

Response: `440`
'the table `ucor1` contains 440 frequency values.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]CORRection:CSET:DATA:POWer -40dB ... 6dB {,-40dB ... 6dB}

The command transfers the level data to the table selected with `:CORRection:CSET:SELect`.

*RST does not affect data lists. .

Example: `CORR:CSET 'var/lists/ucor/ucor1'`
'selects the table ucor1.

`CORR:CSET:DATA:POW 1dB, 0.8dB, 0.75dB,...`
'enters the level values in the table ucor1.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]CORRection:CSET:DATA:POWer:POINts?

The command queries the number of level values in the selected table.

The command is a query command and therefore has no *RST value.

Example: `CORR:CSET 'var/lists/ucor/ucor1'`
'selects the table `ucor1`.

`CORR:CSET:DATA:POW:POIN?`
'queries the number of level values in the table `ucor1`.

Response: `440`
'the table `ucor1` contains 440 level values.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]CORRection:CSET:DATA[:SENSor][:POWer]:SONCe

The command activates the filling of the user correction list with level values acquired by the power sensor.

The command activates the filling of the user correction list with level values acquired by the selected power sensor. All level correction values for the given frequency values are entered in the selected list.

The command is an event and therefore has no *RST value and no query.

Example: `"CORR:CSET:DATA:SENS:POW:SONC"`
' fills the user correction list with level values acquired by the power sensor.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce:]CORRection:CSET:DELete <table name>

The command deletes the specified table.

The lists are stored with the fixed file extensions ***.uco** in a directory of the user's choice. The directory applicable to the commands is defined with the command `MMEMory:CDIR`.

The command is an event and therefore has no *RST value. The numerical suffix under SOURce is irrelevant.

Example: `MMEM:CDIR 'var/lists/ucor'`
'selects the directory for the user correction files.

`CORR:CSET:DEL 'UCOR1'`
'deletes the table `ucor1`.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]CORRection:DEXChange:AFILe:CATalog?

The command requests a list of available ASCII files for export/import of user correction data. The individual files are separated by commas.

The ASCII files are stored with the fixed file extensions ***.txt** or *.**csv** in a directory of the user's choice. The directory applicable to the commands is defined with the command `MMEMory:CDIR`.

The command is a query command and therefore has no *RST value.

Example: `MMEM:CDIR 'var/lists/ucor/import'`
'selects the directory for the ASCII files with frequency and level value pairs.

`CORR:DEXC:AFIL:EXT TXT`
'selects that ASCII files with extension *.txt are listed.

`CORR:DEXC:AFIL:CAT?`
'queries the available files with extension *.txt.

Response: `'ucor1,ucor2'`
'the ASCII files `ucor`1.txt and `ucor2`.txt are available.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]CORRection:DEXChange:AFILe:EXTension TXT | CSV

The command selects the file extension of the ASCII file to be imported or exported. Selection TXT (text file) or CSV (Excel file) is available.

Example: `MMEM:CDIR 'var/lists/ucor/import'`
'selects the directory for the ASCII files with frequency and level value pairs.

`CORR:DEXC:AFIL:EXT TXT`
'selects that ASCII files with extension *.txt are listed.

`CORR:DEXC:AFIL:CAT?`
'queries the available files with extension *.txt.

Response: `'list1,list2'`
'the ASCII files `ucor`1.txt and `ucor2`.txt are available.

*RST value	Resolution	Options	SCPI
TXT	-		Device-specific

[SOURce:]CORRection:DEXChange:AFILe:SELect <ascii_file_name>

The command selects the ASCII file to be imported or exported.

The ASCII files are stored with the fixed file extensions ***.txt** or *.**csv** in a directory of the user's choice. The directory applicable to the commands is defined with the command `MMEMory:CDIR`. A path can also be specified in command `SOUR:CORR:DEXC:AFIL:SEL`, in which case the files are stored or loaded in the specified directory.

Example: `CORR:DEXC:MODE IMP`
'selects that ASCII files with frequency and level value pairs are imported and transferred into user correction lists.

`CORR:DEXC:AFIL:SEL ''var/rs_gen/ucor/import/ucor.csv'`
'selects that ASCII file ucor.csv is imported.

`CORR:DEXC:SEL ''var/rs_gen/ucor/import/ucor_imp'`
'selects that the ASCII file ucor.csv is imported into user correction list ucor_imp.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]CORRection:DEXChange:AFILe:SEParator:COLumn TABulator | SEMicolon | COMMa | SPACe

The command selects the separator between the frequency and level column of the ASCII table.

Example:
```
CORR:DEXC:MODE EXP
```
'selects that the user correction list is exported into an ASCII file.
```
CORR:DEXC:AFIL:SEL ''var/rs_gen/ucor/import/ucor.csv'
```
'selects ASCII file ucor.csv as destination for the user correction list data.
```
CORR:DEXC:AFIL:SEP:COL TAB
```
'the pairs of frequency and level values are separated by a tabulator.
```
CORR:DEXC:AFIL:SEP:DEC DOT
```
'selects the decimal separator dot.
```
CORR:DEXC:SEL ''var/rs_gen/ucor/import/ucor_imp'
```
'selects that the user correction list ucor_imp is imported into ASCII file ucor.csv .

*RST value	Resolution	Options	SCPI
SEMicolon	-		Device-specific

[SOURce:]CORRection:DEXChange:AFILe:SEParator:DECimal DOT | COMMa

The command the decimal separator used in the ASCII data between '.' (decimal point) and ',' (comma) with floating-point numerals.

Example:
```
CORR:DEXC:MODE EXP
```
'selects that the user correction list is exported into an ASCII file.
```
CORR:DEXC:AFIL:SEL ''var/rs_gen/ucor/import/ucor.csv'
```
'selects ASCII file ucor.csv as destination for the user correction list data.
```
CORR:DEXC:AFIL:SEP:COL TAB
```
'the pairs of frequency and level values are separated by a tabulator.
```
CORR:DEXC:AFIL:SEP:DEC DOT
```
'selects the decimal separator dot.
```
CORR:DEXC:SEL ''var/rs_gen/ucor/import/ucor_imp'
```
'selects that the user correction list ucor_imp is imported into ASCII file ucor.csv .

*RST value	Resolution	Options	SCPI
DOT	-		Device-specific

[SOURce:]CORRection:DEXChange:EXECute

The command starts the export or import of the selected file. When import is selected, the ASCII file is imported as user correction list. When export is selected, the user correction list is exported into the selected ASCII file.

The command triggers an event and therefore has no *RST value.

Example: `CORR:DEXC:MODE IMP`
'selects that ASCII files with frequency and level value pairs are imported and transferred into user correction lists.

`CORR:DEXC:AFIL:SEL ''var/rs_gen/ucor/import/ucor.csv'`
'selects that ASCII file ucor.csv is imported.

`CORR:DEXC:SEL ''var/rs_gen/ucor/import/ucor_imp'`
'selects that the ASCII file ucor.csv is imported into user correction list ucor_imp.

`CORR:DEXC:EXEC`
'starts the import of the ASCII file data into the user correction file.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]CORRection:DEXChange:MODE IMPort | EXPort

The command selects if user correction lists should be imported or exported. Depending on the selection her, the file select command define either the source or the destination for user correction lists and ASCII files.

Example: `CORR:DEXC:MODE IMP`
'selects that ASCII files with frequency and level value pairs are imported and transferred into user correction lists.

`CORR:DEXC:AFIL:SEL ''var/rs_gen/ucor/import/ucor.csv'`
'selects that ASCII file ucor.csv is imported.

`CORR:DEXC:SEL ''var/rs_gen/ucor/import/ucor_imp'`
'selects that the ASCII file ucor.csv is imported into user correction list ucor_imp.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]CORRection:DEXChange:SELect <list_name>

The command selects the user correction list to be imported or exported. .

The user correction files are stored with the fixed file extensions ***.uco** in a directory of the user's choice. The directory applicable to the commands is defined with the command `MMEMory:CDIR`. A path can also be specified in command `SOUR:CORR:DEXC:SEL`, in which case the files are stored or loaded in the specified directory.

Example: `CORR:DEXC:MODE IMP`
'selects that ASCII files with frequency and level value pairs are imported and transferred into user correction lists.

`CORR:DEXC:AFIL:SEL ''var/rs_gen/ucor/import/ucor.csv'`
'selects that ASCII file ucor.csv is imported.

`CORR:DEXC:SEL ''var/rs_gen/ucor/import/ucor_imp'`
'selects that the ASCII file ucor.csv is imported into user correction list ucor_imp.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]CORRection:CSET[:SELect] <table name>

The command selects the table for user correction. Level correction must also be activated with the command `SOURce<[1]|2>:CORRection:CSET:STATe ON`.

The lists are stored with the fixed file extensions ***.uco** in a directory of the user's choice. The directory applicable to the commands is defined with the command `MMEMory:CDIR`. A path can also be specified in command `:SOUR:CORR:CSET:SEL`, in which case the files in the specified directory are selected.

The command is an event and therefore has no *RST value.

Example: `CORR:CSET 'var/lists/ucor/ucor1'`
'selects the table `ucor1`.

`CORR ON`
'activates level correction. Correction is performed using the table `ucor1`.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]CORRection[:STATe] ON | OFF

The command activates/deactivates level correction. Level correction is performed using the table which has been selected with the command `CORRection:CSET:SELect`.

Example: `SOUR:CORR:CSET 'ucor1`
'selects the table `ucor1`.

`SOUR:CORR ON`
'activates user correction.

*RST value	Resolution	Options	SCPI
OFF	-		Device-specific

[SOURce:]CORRection:VALue?

The command requests the current value for user correction.

This command is a query command and has no *RST value.

Example: `CORR:VAL?`
'queries the value currently used for level correction.

Response: `-3`
'the correction value is - 3dB.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SOURce:FM Subsystem

The FM subsystem contains the commands for checking the frequency modulation. The FM-specific characteristics of the internal modulation source are defined with commands SOURce:FM:INTernal:... Characteristics which are valid for all modulations and the LF Output are configured in the SOURce:LFOutput subsystem (e.g. frequency). The external signal is input at the **MOD EXT** connector.

The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]FM[:DEViation]	<numeric_value>	Hz	
[SOURce:]FM:EXTernal:COUPling	AC | DC		
[SOURce:]FM:EXTernal:DEViation	0 Hz…40 MHz	Hz	
[SOURce:]FM:SENSitivity?	0 Hz…40 MHz	Hz	Query only
[SOURce:]FM:SOURce	EXT | INT		
[SOURce:]FM:STATe	ON | OFF		

[SOURce:]FM[:DEViation] 0 Hz ... 20 MHz

The command sets the modulation deviation of the frequency modulation in Hz. The maximal deviation depends on the RF frequency set and the selected modulation mode (see data sheet).

Example: `FM 5E3`
'sets the FM modulation deviation to 5 kHz.

*RST value	Resolution	Options	SCPI
10 kHz	See data sheet		Compliant

[SOURce:]FM:EXTernal:COUPling AC | DC

The command selects the coupling modefor the external modulation input (MOD EXT) in the case of frequency modulation.

Note:
Coupling for external feed via input MOD EXT can be set independently for all modulations.

Parameters: **AC**
The DC voltage component is disconnected from the modulation signal.

DC
The modulation signal is not changed.

Example: `FM:EXT:COUP AC`
'selects the coupling mode AC for external frequency modulation.

*RST value	Resolution	Options	SCPI
AC	-		Compliant

[SOURce:]FM:EXTernal:DEViation 0 … 40 MHz

The command enters the deviation of the external FM signal

Example: `FM:EXT:DEV 3kHz`
'sets an external modulation depth of 3 kHz

*RST value	Resolution	Options	SCPI
1 kHz	-		Compliant

[SOURce:]FM:SENSitivity?

The command queries the input sensitivity of the **MOD EXT** input in Hz/V. The command is only effective if the external modulation source is selected (`SOUR:FM:SOUR EXT`). The returned value depends on the modulation deviation setting (`SOUR:FM:DEViation`). This value is assigned to the voltage value for full modulation of the input.

The command is a query command and therefore has no *RST value.

Example: `FM:DEV 5E3`
'sets a modulation deviation of 5 kHz.

`FM:SENS?`
'queries the input sensitivity at the MOD EXT input.

Response: `5E3`
'since the voltage value for full modulation is 1V, the resulting sensitivity is precisely 5000Hz/V.

*RST value	Resolution	Options	SCPI
-	-		Compliant

[SOURce:]FM:SOURce EXT | INT

The command selects the modulation source for frequency modulation. INT is the internal modulation source which is configured in the SOURce:LFOutput subsystem. The external signal is input at the **MOD EXT** connector."

Example: `FM:SOUR INT`
'selects the internal modulation source.

*RST value	Resolution	Options	SCPI
INTernal	-		Compliant

[SOURce:]FM:STATe ON | OFF

The command activates/deactivates frequency modulation.

Activation of frequency modulation deactivates phase modulation.

Example: `FM:STAT ON`
'activates FM modulation.

*RST value	Resolution	Options	Correlation	SCPI
OFF	-		FM ON deactivates phase modulation.	Compliant

SOURce:FREQuency Subsystem

This subsystem contains the commands used to define the frequency settings for the RF sources and sweeps.

The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]FREQuency:CENTer	300 kHz...RF_{max}	Hz	
[SOURce:]FREQuency[:CW|:FIXed]	300 kHz...RF_{max}	Hz	
[SOURce:]FREQuency[:CW|:FIXed]:RCL	INCLude | EXCLude		
[SOURce:]FREQuency:MANual	300 kHz...RF_{max}	Hz	
[SOURce:]FREQuency:MODE	CW|FIXed | SWEep		
[SOURce:]FREQuency:OFFSet	50 ...+50 GHz	Hz	
[SOURce:]FREQuency:SPAN	0...RF_{max}	Hz	
[SOURce:]FREQuency:STARt	300 kHz...RF_{max}	Hz	
[SOURce:]FREQuency:STEP[:INCRement]	0...RF_{max} - 100 kHz	Hz	
[SOURce:]FREQuency:STEP:MODE	USER | DECimal		
[SOURce:]FREQuency:STOP	300 kHz...RF_{max}	Hz	

[SOURce:]FREQuency:CENTer 300 kHz...RF_{max} (RF_{max} depending on model)

The command sets the center frequency of the sweep. This setting in combination with the span setting (`[SOURce:]FREQuency:SPAN`) defines the sweep range.

This command is linked to the commands `[SOURce:]FREQuency:STARt` and `[SOURce:]FREQuency:STOP`, i.e. changing these values causes the `CENTer` value to change, and vice versa:

`CENTer` = (`STARt` + `STOP`)/2.

As with the **Frequency** value entered in the header, the `Offset` value is also taken into consideration with this command. The specified value range is therefore only effective if `Offset` is set to 0. The value range for other `Offset` values can be calculated using the following formula:

300 kHz + `Offset` ... RF_{max} + `Offset`

Example:
```
FREQ:CENT 400 MHz
```
'sets the center frequency for the frequency sweep to 400 MHz.
```
FREQ:SPAN 200 MHz
```
'sets a span of 200 MHz. This sets the sweep range to 300 MHz to 500 MHz.

*RST value	Resolution	Options	Correlation	SCPI
300 MHz	0.01 Hz		CENTer = (STARt + STOP)/2	Compliant

[SOURce:]FREQuency[:CW|:FIXed] 300 kHz ... RF_{max}

The command sets the frequency of the RF output signal for CW mode (`SOURce:FREQuency:MODE CW`). In Sweep mode (`SOURce:FREQuency:MODE SWEep`), this value is linked to the current sweep frequency.

In addition to a numerical value, it is also possible to specify `UP` and `DOWN`. The frequency is then increased or decreased by the value which is set under `[SOURce:]FREQuency:STEP`.

As with the **FREQ** value entered in the display, the `Offset` value is also taken into consideration with this command. The specified value range is therefore only effective if `Offset` is set to 0. The value range for other `Offset` values can be calculated using the following formula:

300 kHz + `Offset` ... RF_{max} + `Offset`

Example: `FREQ 500kHz`
'sets the frequency of RF output signal A to 500 kHz'.

*RST value	Resolution	Options	Correlation	SCPI
1 GHz	0.01 Hz		`:FREQ` for `FREQ:MODE SWE` linked to sweep frequency.	Compliant

[SOURce:]FREQuency[:CW|:FIXed]:RCL INCLude | EXCLude

The command determines whether the current frequency setting is retained or whether the stored frequency setting is adopted when an instrument configuration is loaded.

*RST does not affect this setting.

Parameters:

INCLude
The stored frequency is also loaded when a stored instrument configuration is loaded.

EXCLude
The RF frequency is not loaded when a stored instrument configuration is loaded. The current frequency is retained.

Example: `FREQ:RCL INCL`
'the stored frequency is set if the Recall command is called'.

*RST value	Resolution	Options	SCPI
-	-		Compliant

[SOURce:]FREQuency:MANual STARt ... STOP

In Sweep mode (`:SOUR:FREQ:MODE SWE`) the command sets the frequency for the next sweep step in the **Step** sweep mode (`SOUR:SWE:MODE MAN`). Here only frequency values between the settings `[SOUR]:FREQ:STAR` and `...:STOP` are permitted. Each sweep step is triggered by a separate `SOUR:FREQ:MAN` command.

As with the **Frequency** value entered in the header, the `Offset` value is also taken into consideration with this command. The specified value range is therefore only effective if `Offset` is set to 0. The value range for other `Offset` values can be calculated using the following formula (see also Chapter 4).

`STARt` + `Offset` ... `STOP` + `Offset`

Example:

```
SWE:MODE MAN
```
'sets the **Step** sweep mode.

```
FREQ:MAN 500MHz
```
'sets an RF frequency of 500 MHz for the next step in the **Step** sweep mode.

```
FREQ:MODE SWE
```
'sets the Frequency Sweep mode. An RF frequency of 500 MHz is output.

```
FREQ:MAN 550MHz
```
'triggers the next sweep step with an RF frequency of 550 MHz.

*RST value	Resolution	Options	SCPI
100 MHz	0.01 Hz		Compliant

[SOURce:]FREQuency:MODE CW|FIXed | SWEep

The command sets the instrument operating mode and therefore also the commands used to set the output frequency.

Parameters:

CW|FIXed
The instrument operates in fixed-frequency mode. CW and FIXed are synonyms. The output frequency is set with `:SOURce:FREQuency:CW|FIXed`.

SWEep
The instrument operates in SWEep mode. The frequency is set using the commands `SOURce:FREQuency:STARt; STOP; CENTer; SPAN; MANual`.

Example:

```
FREQ:MODE SWE
```
'sets the SWEep mode. The settings under `SOURce:FREQuency:STARt; STOP; CENTer; SPAN; MANual` become effective.

*RST value	Resolution	Option	Correlation	SCPI
CW	-			Compliant

[SOURce:]FREQuency:OFFSet -50 GHz ... + 50 GHz

The command sets the frequency offset of a downconversion instrument, e.g. a mixer. If a frequency offset is entered, the frequency entered with `SOURce:FREQuency:...` no longer corresponds to the RF output frequency. The following correlation applies:

`SOURce:FREQuency:...` = RF output frequency `+ SOURce:FREQuency:Offset`.

Entering an offset does not change the RF output frequency, but rather the query value of `SOURce:FREQuency:.....`

Example:
```
SOUR:FREQ:OFFS 500kHz
```
'sets the frequency offset to 500 kHz.

*RST value	Resolution	Options	SCPI
0 Hz	0.01 Hz		Compliant

[SOURce:]FREQuency:SPAN 0...RF_{max} (RF_{max} depending on model)

This command specifies the span for the sweep. This setting in combination with the center frequency setting (`[SOUR]:FREQ:CENT`) defines the sweep range.

This command is linked to the commands `[SOUR]:FREQ:STAR` and `[:SOUR]:FREQ:STOP`, i.e. changing these values causes the `SPAN` value to change, and vice versa:

`SPAN` = (`STOP - STARt`)

Negative values for SPAN are permitted; STARt > STOP then applies.

Example:
```
FREQ:CENT 400 MHz
```
'sets the center frequency of the frequency sweep to 400 MHz.
```
FREQ:SPAN 200 MHz
```
'sets a span of 200 MHz. This sets the sweep range to 300 MHz to 500 MHz.

*RST value	Resolution	Options	Correlation	SCPI
400 MHz	0.01 Hz		SPAN = (STOP - STARt)	Compliant

[SOURce:]FREQuency:STARt 300 kHz...RF_{max} (RF_{max} depending on model)

This command sets the start frequency for the sweep mode. `STARt` can be greater than `STOP`.

This command is linked to the commands `[SOUR]:FREQ:CENT` and `[SOUR]:FREQ:SPAN`, i.e. changing these values causes the `STARt` value to change, and vice versa:

`STARt` = (`CENTer - SPAN/2`).

As with the **Frequency** value entered in the header, the `Offset` value is also taken into consideration with this command. The specified value range is therefore only effective if `Offset` is set to 0. The value range for other `Offset` values can be calculated using the following formula:

300 kHz + `Offset` ... RF_{max} + `Offset`

Example:
```
FREQ:STARt 1 MHz
```
'sets the start frequency for the frequency sweep to 1 MHz.
```
FREQ:STOP 2 GHz
```
'sets the stop frequency for the frequency sweep to 2 GHz.

*RST value	Resolution	Options	Correlation	SCPI
100 MHz	0.01 Hz		STARt = (CENTer - SPAN/2)	Compliant

[SOURce:]FREQuency:STEP[:INCRement] 0 Hz ... RF_{max} - 100 kHz

The command sets the step width for the frequency setting if the frequency values `UP/DOWN` are used and variation mode `SOUR:FREQ:STEP:MODE USER` is selected. The command is linked to **Variation Step** for manual control, i.e. the command also sets the step width of the rotary knob for **Variation Active on**.

Example: `FREQ:STEP 50 kHz`
'sets the step width for the frequency setting to 50 kHz'.

*RST value	Resolution	Options	SCPI
1 MHz	0.01 Hz		Device-specific

[SOURce:]FREQuency:STEP:MODE USER | DECimal

This command activates (`USER`) or deactivates (`DECimal`) the user-defined step width used when varying the frequency value with the frequency values `UP/DOWN`. The command is linked to the command **Variation Active** for manual control, i.e. the command also activates/deactivates the user-defined step width used when varying the frequency value with the rotary knob.

Example: `FREQ:STEP 50 kHz`
'sets the step width for the frequency setting to 50 kHz'.

`FREQ:STEP:MODE USER`
'actives this step width for frequency variation with the rotary knob (manual control) and with frequency values `UP/DOWN` (remote control)'.

*RST value	Resolution	Options	SCPI
DECimal	-		Device-specific

[SOURce:]FREQuency:STOP 300 kHz...RF_{max} (RF_{max} depending on model)

This command sets the stop frequency for the sweep mode. `STOP` can be less than `STARt`.

This command is linked to the commands `[:SOUR]:FREQ:CENt` and `[:SOUR]:FREQ:SPAN`, i.e. changing these values causes the `STARt` value to change, and vice versa:

`STOP` = (`CENTer + SPAN/2`).

As with the **Frequency** value entered in the header, the `Offset` value is also taken into consideration with this command. The specified value range is therefore only effective if `Offset` is set to 0. The value range for other `Offset` values can be calculated using the following formula:

300 kHz + `Offset` ... RF_{max} + `Offset`

Example: `FREQ:STOP 2 GHz`
'sets the stop frequency for the frequency sweep to 2 GHz.

`FREQ:STAR 1 MHz`
'sets the start frequency for the frequency sweep to 1 MHz.

*RST value	Resolution	Options	Correlation	SCPI
500 MHz	0.01 Hz		STOP = (CENTer + SPAN/2)	Compliant

SOURce:INPut Subsystem

The SOURce:INPut subsystem contains the commands for configuring the inputs for external pulse modulation signals.

The instrument trigger setting influences all sweeps (Instrument Trigger).

Command	Parameters	Default unit	Remark
[SOURce:]INPut:TRIGger:SLOPe	POSitive | NEGative		

[SOURce:]INPut:TRIGger:SLOPe POSitive | NEGative

The command sets the active slope of an externally applied trigger signal at the INST TRIG inputs (BNC connector at the rear of the instrument). The setting is effective for both inputs at the same time.

Example: `INP:TRIG:SLOP NEG`
'the active slope of the external trigger signal at the **INST TRIG** inputs is the falling slope.

*RST value	Resolution	Options	SCPI
POSitive	-		Device-specific

SOURce:LFOutput Subsystem

This subsystem contains the commands for setting the LF signal source in CW and Sweep mode as well as for analog modulations.

An LF sweep is set in several steps which are shown in the following example:

1. Set the sweep range.
```
LFOutput:FREQuency:STARt  4 kHz
LFOutput:FREQuency:STOP  10 kHz
```

2. Select linear or logarithmic sweep spacing.
```
LFOutput:SWEep[:FREQuency]:SPACing LIN
```

3. Set the step width and dwell time.
```
LFOutput:SWEep[:FREQuency]:STEP[:LINear]  100 Hz
LFOutput:SWEep[:FREQuency]:DWELl 20 ms
```

4. Determine the sweep mode.
```
LFOutput:SWEep:MODE AUTO
```

5. Determine the trigger.
```
TRIGger0:SOURce SINGle
```

6. Activate the sweep.
```
LFOutput:FREQuency:MODE SWEep
```

7. Trigger the sweep (depending on the mode).
```
LFOutput:SWEep:EXECute
```

The keyword SOURce is optional and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]LFOutput:FREQuency	Min … max	Hz	See data sheet
[SOURce:]LFOutput:FREQuency:MANual	0.1 Hz ... 1 MHz	Hz	
[SOURce:]LFOutput:FREQuency:MODE	CW | FIXed | SWEep		
[SOURce:]LFOutput:FREQuency:STARt	0.1 Hz ... 1 MHz	Hz	
[SOURce:]LFOutput:FREQuency:STOP	0.1 Hz ... 1 MHz	Hz	
[SOURce:]LFOutput[:STATe]	ON | OFF		
[SOURce:]LFOutput:SWEep[:FREQuency]:DWELl	2 ms ... 10 s	s	
[SOURce:]LFOutput:SWEep[:FREQuency]:EXECute	-		
[SOURce:]LFOutput:SWEep[:FREQuency]:MODE	AUTO | MANual | STEP		
[SOURce:]LFOutput:SWEep[:FREQuency]:POINts	<numeric_value>		
[SOURce:]LFOutput:SWEep[:FREQuency]:SHAPe	SAWTooth | TRIangle		
[SOURce:]LFOutput:SWEep[:FREQuency]:SOURce	LF1 | LF2		
[SOURce:]LFOutput:SWEep[:FREQuency]:SPACing	LINear | LOGarithmic		
[SOURce:]LFOutput:SWEep[:FREQuency]:STEP[:LINear]	0 ... (STOP - STARt)	Hz	
[SOURce:]LFOutput:SWEep[:FREQuency]:STEP:LOGarithmic	0.01 ... 50 PCT	PCT	
[SOURce:]LFOutput:VOLTage	0 V ... 4 V	V	

SOURce-LFOutput - LF-Frequency[SOURce:]LFOutput:FREQuency 0.001 V... 4 V

The command sets the frequency of the LF signal for CW mode (`:SOUR:MODE CW` mode). The setting is valid for all analog modulations (AM/FM/PhiM) with internal modulation source and for the LF Output.

In Sweep mode (`SOUR:LFO:FREQ:MODE SWE`), the frequency is linked to the sweep frequency. "

Example: `LFO2:FREQ 5kHz`
'sets the frequency of the LF generator 2 signal to 5 kHz'.

*RST value	Resolution	Options	Correlation	SCPI
1 kHz	0.1 Hz		`LFO:FREQ` for `LFO:FREQ:MODE SWE` linked to sweep frequency	Compliant

[SOURce:]LFOutput:FREQuency:MANual 0.1 Hz... 1 MHz

In Sweep mode (`SOUR:LFO:FREQ:MODE SWE`) the command sets the frequency for the next sweep step in the **Step** sweep mode (`SOUR:LFO:SWE:MODE MAN`). Here only frequency values between the settings `SOUR:LFO:FREQ:STAR` and `...:STOP` are permitted. Each sweep step is triggered by a separate `SOUR:LFO:FREQ:MAN` command.

Example:

```
LFO:SWE:MODE MAN
```
'sets the **Step** sweep mode.

```
LFO:FREQ:MAN 5 kHz
```
'sets an LF frequency of 5 kHz for the next step in the **Step** sweep mode.

```
LFO:FREQ:MODE SWE
```
'sets the LF Sweep mode. An LF frequency of 5 kHz is output.

```
LFO:FREQ:MAN 5.1 kHz
```
'triggers the next sweep step with a frequency of 5.1 kHz.

*RST value	Resolution	Options	SCPI
1 kHz	0.1 Hz.	-	Compliant

[SOURce:]LFOutput:FREQuency:MODE CW|FIXed | SWEep

The command sets the instrument LF operating mode and therefore also the commands used to set the output frequency.

Parameters:

CW|FIXed
The instrument operates in fixed-frequency mode. CW and FIXed are synonyms. The output frequency is set with `[SOURce:]LFOutput:FREQuency`.

SWEep
The instrument operates in SWEep mode. The frequency is set using the commands `SOURce:LFOutput:FREQuency:STARt; STOP` or `MANual`.

Example:

```
LFO:FREQ:MODE SWE
```
'sets the SWEep mode. The settings under `SOURce:LFOutput:FREQuency:STARt; STOP; MANual` become effective.

*RST value	Resolution	Options	SCPI
CW	-	-	Compliant

[SOURce:]LFOutput:FREQuency:STARt 0.1 Hz... 1 MHz

This command sets the start frequency for the LF Sweep mode.

Example:

```
RST*
```
'activates all presettings.

```
LFO:SWE:MODE AUTO
```
'sets the AUTO sweep mode, i.e. each trigger triggers a complete sweep.

```
TRIG:FSW:SOUR SING
```
'sets the SINGle trigger mode, i.e. the sweep is triggered by the command `:LFOutput:SWEep:EXECute` or `*TRG`.

```
LFO:FREQ:STAR 100 kHz
```
'sets the start frequency for the LF sweep to 100 kHz.

```
LFO:FREQ:STOP 200 kHz
```
'sets the stop frequency of the LF sweep to 200 kHz.

```
LFO:FREQ:MODE SWE
```
'sets the LF sweep mode.

```
LFO:SWE:EXEC
```
'a one-off LF sweep from 100 kHz to 200 kHz is performed. The linear step width is 1 kHz with a dwell time of 15 ms (preset values).

*RST value	Resolution	Options	SCPI
1 kHz	0.1 Hz	-	Compliant

[SOURce:]LFOutput:FREQuency:STOP 0.1 Hz... 1 MHz

This command sets the stop frequency for the LF sweep.

Example:

```
LFO:FREQ:STOP 200 kHz
```
'sets the stop frequency for the LF sweep to 200 kHz.

```
LFO:FREQ:STAR 100 kHz
```
'sets the start frequency for the LF sweep to 100 kHz.

*RST value	Resolution	Options	SCPI
50 kHz	0.1 Hz	-	Compliant

[SOURce:]LFOutput[:STATe] ON | OFF

The command activates/deactivates the LF output.

Example:

```
LFO ON
```
'activates the LF output. The settings under `LFO:FREQ` and `LFO:SWE` become effective.

*RST value	Resolution	Options	SCPI
OFF	-	-	Device-specific

[SOURce:]LFOutput:SWEep[:FREQuency]:DWEL 2 ms...10 s

The command sets the dwell time for each frequency step of the sweep.

Note:
It is recommended to switch off the GUI update for optimum sweep performance especially with short dwell times (SYSTem:DISPlay:UPDate OFF).

Example: `LFO:SWE:DWEL 20 ms`
'sets a dwell time of 20 ms.

*RST value	Resolution	Options	SCPI
10 ms	0.1 ms	-	Device-specific

[SOURce:]LFOutput:SWEep[:FREQuency]:EXECute

The command immediately starts an LF sweep. The command is only valid for sweep mode Single (`SOURce:LFOutput:SWEep:FREQuency:MODE SINGle`). The command corresponds to the manual-control command EXECUTE SINGLE SWEEP.

This command triggers an event and therefore has no *RST value.

Example: `LFO:SWE:MODE SING`
'sets the single cycle mode of the LF sweep.

`LFO:SWE:EXEC`
'starts one cycle of the LF sweep.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]LFOutput:SWEep[:FREQuency]:MODE AUTO | MANual | STEP

The command sets the cycle mode of the LF sweep.

The assignment of the IEC/IEEE-bus commands to the sweep modes is given in the description of the sweep menus.

Parameters:

AUTO
Each trigger triggers exactly one complete sweep.

MANual
The trigger system is not active. Each frequency step of the sweep is triggered individually, either by varying the **Current Frequency** value using the rotary knob under manual control or by means of a `:LFOutput:FREQ:MAN` command under remote control. With manual control, the frequency increases or decreases (depending on the direction of the rotary encoder) by the value specified under `SOUR:LFO:SWE:FREQ:STEP:LIN` (linear spacing) or `...:STEP:LOG` (logarithmic spacing). With remote control, the frequency increases by the value specified under `LFO:SWE:FREQ:STEP:LIN|LOG` which each sent `:LFO:FREQ:MAN` command, irrespective the value entered there.

STEP
Each trigger triggers one sweep step only. The frequency increases by the value entered under `[SOURce:]LFOutput:SWEep:STEP`.

Example:
```
LFO:SWE:MODE AUTO
```
'selects auto mode.

*RST value	Resolution	Options	SCPI
AUTO	-	-	Device-specific

[SOURce:]LFOutput:SWEep[:FREQuency]:POINts <numeric_value>

The command sets the number of steps in an LF sweep. The command is linked to the command `:LFOutput:SWEep[:FREQuency]:STEP` as follows:

The following applies for linear sweeps and `STARt < STOP`: `POINts = ((STOP-STARt) / STEP:LIN) + 1`

The following applies for logarithmic sweeps and `STARt < STOP`:

```
POINts = ((log STOP - log STARt) / log STEP:LOG) + 1
```

If `POINTs` changes, the value of `STEP` is adjusted. The `STARt` and `STOP` value is retained.

Two separate POINts values are used for linear or logarithmic sweep spacing (`LFOutput:SWEep[:FREQuency]:SPACing LIN | LOG`). The command is always effective for the currently set sweep spacing.

Example: LFO:FREQ:STAR
'sets the start frequency to 2 kHz.

LFO:FREQ:STOP
'sets the stop frequency to 20 kHz.

LFO:SWE:SPAC LIN
'sets linear sweep spacing.

LFO:SWE:POIN 11
'sets 11 sweep steps for linear sweep spacing. The sweep step width (STEP) is automatically set to 2 kHz.

*RST value	Resolution	Options	Correlation	SCPI
100	1	-	The value of :LFO:SWE:STEP is adjusted automatically.	Device-specific (adapted to instrument properties)

[SOURce:]LFOutput:SWEep[:FREQuency]:SOURce LF1 | LF2

The command selects the source for the LFsweep.

Example: SWE:LFS LF2
'selects LF generator 2 as the LF frequency sweep source

*RST value	Resolution	Options	SCPI
LF1	-		Device-specific

[SOURce:]LFOutput:SWEep[:FREQuency]:SHAPe SAWTooth | TRIangle

The command sets the cycle mode for a sweep sequence (shape).

Parameters:

SAWTooth
One sweep runs from start to stop frequency. Each subsequent sweep starts at the start frequency, i.e. the shape of the sweep sequence resembles a sawtooth.

TRIangle
One sweep runs from start to stop frequency and back, i.e. the shape of the sweep resembles a triangle. Each subsequent sweep starts at the start frequency.

Example: SOUR:LFO:SWE:SHAP TRI
'selects the sweep cycle with alternating ascending and descending sweep directions.

*RST value	Resolution	Options	SCPI
SAWTooth	-		Device-specific

[SOURce:]LFOutput:SWEep[:FREQuency]:SPACing LINear | LOGarithmic

The command selects linear or logarithmic sweep spacing.

Example: `LFO:SWE:SPAC LIN`
'selects linear sweep spacing.

*RST value	Resolution	Options	SCPI
LINear	-	-	Device-specific

[SOURce:]LFOutput:SWEep[:FREQuency]:STEP[:LINear] 0 ... (STOP - STARt)

The command sets the step width for the linear sweep.

This command is linked to the command `:LFOutput:SWEep[:FREQuency]:POINts` as follows:

The following applies for `STARt < STOP`: `POINts = (((STOP-STARt) / STEP:LIN) + 1`

If `STEP:LIN` changes, the value of `POINTs` is adjusted. The `STARt` and `STOP` value is retained.

Example: `LFO:FREQ:STAR`
'sets the start frequency to 2 kHz.

`LFO:FREQ:STOP`
'sets the stop frequency to 20 kHz.

`LFO:SWE:SPAC LIN`
'sets linear sweep spacing.

`LFO:SWE:STEP 2 kHz`
'sets the sweep step width to 2 kHz. The number of sweep steps for linear sweep spacing (`POINts`) is automatically set to 11.

*RST value	Resolution	Options	Correlation	SCPI
1kHz	0.1 Hz	-	The value of `:LFO:SWE:POIN` is adjusted automatically.	Device-specific

[SOURce:]LFOutput:SWEep[:FREQuency]:STEP:LOGarithmic 0.01 ... 100 PCT

The command specifies the step width factor for logarithmic sweeps. The next frequency value of a sweep is calculated (for `STARt < STOP`) using the following formula:

New frequency = Old frequency + `STEP:LOG` x Old frequency

`STEP:LOG` therefore gives the fraction of the old frequency. The frequency is increased by this fraction for the next sweep step. Usually `STEP:LOG` is given in percent, whereby the suffix `PCT` must always be used.

The command is linked to the command `:LFOutput:SWEep[:FREQuency]:POINts` as follows:

The following applies for logarithmic sweeps and `STARt < STOP`:
`POINts = ((log STOP - log STARt) / log STEP:LOG) + 1`

If `STEP:LOG` changes, the value of `POINTs` is adjusted. The `STARt` and `STOP` value is retained.

Example: LFO:FREQ:STAR
'sets the start frequency to 1 kHz.

LFO:FREQ:STOP
'sets the stop frequency to 100 kHz.

LFO:SWE:SPAC LOG
'sets logarithmic sweep spacing.

LFO:SWE:STEP:LOG 10PCT
'sets the step width for logarithmic sweep spacing to 10% of the previous frequency in each instance.

*RST value	Resolution	Options	Correlation	SCPI
1 PCT	0.01 PCT	-	The value of :LFO:SWE:POIN is adjusted automatically.	Device-specific

[SOURce:]LFOutput:VOLTage 0 V...4 V

The command sets the output voltage of the LF output.

Example: LFO:VOLT 3 V
'sets the voltage of the LF output to 3 V.

*RST value	Resolution	Options	SCPI
1 V	0.001 V	-	Device-specific

SOURce:MODulation Subsystem

This subsystem contains the command for switching on/off all modulations.

Command	Parameters	Default unit	Remark
[SOURce:]MODulation[:ALL]:STATe	ON | OFF		

[SOURce:]MODulation[:ALL]:STATe ON | OFF

The command switches the modulations on and off. A subsequent command :SOUR:MOD:ALL:STAT ON restores the status that was active before the last switch-off. **MOD** OFF is displayed in the info line of the header next to the **Level** field.

Example: MOD:STAT OFF
'switches off all active modulations

*RST value	Resolution	Options	SCPI
ON	-	-	Device-specific

SOURce:PHASe Subsystem

This subsystem contains the commands for adjusting the phase of the RF output signal relative to a reference signal of the same frequency.

The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]PHASe	-359.9 deg ... +359.9 deg	RAD	
[SOURce:]PHASe:REFerence			No query

[SOURce:]PHASe -359.9 deg ... +359.9 deg

The command specifies the phase variation relative to the current phase. The variation can be specified in RADians.

Example: `PHAS 2DEG`
'changes the phase by 2 degrees relative to the current phase.

`PHAS:REF`
'adopts the set phase as the current phase'.

*RST value	Resolution	Options	SCPI
0.0 deg	0.1 deg		Compliant

[SOURce:]PHASe:REFerence

The command adopts the phase set with `SOURce:PHASe:ADJust` as the current phase.

The command triggers an event and therefore has no *RST value and no query form.

Example: `PHAS 0.1RAD`
'changes the phase by 0.1 rad relative to the current phase.

`PHAS:REF`
'adopts the set phase as the current phase'.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SOURce:PM Subsystem

The PM subsystem contains the commands for checking the phase modulation. The PhiM-specific characteristics of the internal modulation source are defined with commands `SOURce:PM:INTernal:...` Characteristics which are valid for all modulations and the LF Output are configured in the SOURce:LFOutput subsystem (e.g. frequency). The external signal is input at the MOD EXT connector.

Command	Parameters	Default unit	Remark
[SOURce:]PM[:DEViation]	0 ...20 RAD	RAD	
[SOURce:]PM:EXTernal:COUPling	AC | DC		
[SOURce:]PM:EXTernal:DEViation	0 ...160 RAD	RAD	
[SOURce:]PM:SENSitivity?			Query only
[SOURce:]PM:SOURce	EXT | INT		
[SOURce:]PM:STATe	ON | OFF		

[SOURce:]PM[:DEViation] 0 ... 20 RAD

The command sets the modulation deviation of the phase modulation in RAD. The maximal deviation depends on the RF frequency set and the selected modulation mode (see data sheet).

Example: `PM 5E3`
'sets the PM modulation deviation to 5 RAD.

*RST value	Resolution	Options	SCPI
1 RAD	See data sheet		Compliant

[SOURce:]PM:EXTernal:COUPling AC | DC

The command selects the coupling mode for the external modulation input (EXT MOD) in the case of phase modulation.

Note:
Coupling for external feed via input MOD EXT can be set independently for modulations FM and PhiM.

Parameters:

AC
The DC voltage component is disconnected from the modulation signal.

DC
The modulation signal is not changed.

Example: `PM:EXT:COUP AC`
'selects the coupling mode AC for external phase modulation.

*RST value	Resolution	Options	SCPI
AC	-		Compliant

[SOURce:]PM:EXTernal[:DEViation] 0 ... 160 RAD

The command sets the modulation deviation in case of external phase modulation in RAD. The maximal deviation depends on the RF frequency set and the selected modulation mode (see data sheet).

Example: `PM 5E3`
'sets the PM modulation deviation for external phase modulation of 5 RAD.

*RST value	Resolution	Options	SCPI
1 RAD	See data sheet		Compliant

[SOURce:]PM:SENSitivity?

The command queries the input sensitivity of the MOD EXT input in RAD/V. The command is only effective if the external modulation source is selected (`SOUR:PM:SOUR EXT`). The returned value depends on the modulation deviation setting (`SOUR:PM:DEViation`). This value is assigned to the voltage value for full modulation of the input.

The command is a query command and therefore has no *RST value.

Example: `PM:DEV 1`
'sets a modulation deviation of 1RAD.

`PM:SENS?`
'queries the input sensitivity at the EXT MOD input.

Response: `1`
'since the voltage value for full modulation is 1V, the resulting sensitivity is precisely 1RAD/V.

*RST value	Resolution	Options	SCPI
-	-		Compliant

[SOURce:]PM:SOURce EXT | INT

The command selects the modulation source for phase modulation. INT is the internal modulation source which is configured in the SOURce:LFOutput subsystem. The external analog signal is input at the **MOD EXT** connector."

Example: `PM:SOUR INT`
'selects the internal modulation source.

*RST value	Resolution	Options	SCPI
INTernal	-		Compliant

[SOURce:]PM:STATe ON | OFF

The command activates/deactivates phase modulation.

Activation of phase modulation deactivates frequency modulation.

Example: `PM:STAT ON`
'activates PM modulation.

*RST value	Resolution	Options	Correlation	SCPI
OFF	-		`PM:STATe ON` deactivates frequency modulation.	Compliant

SOURce:POWer Subsystem

This subsystem contains the commands for setting the output level, level control and level correction of the RF signal. Other units can also be used instead of dBm:

- by entering the unit directly after the numerical value (example `:POW 0.5V`),
- by changing the DEFault unit in the UNIT system (see the command `UNIT:POWER`).

The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]POWer:ALC:OMODe	SHOLd		
[SOURce:]POWer:ALC:SONCe			No query
[SOURce:]POWer:ALC[:STATe]	ON | OFF | AUTO		
[SOURce:]POWer:[LEVEL][:IMMediate][:AMPLitude]	<numeric_value>	dBm	See data sheet
[SOURce:]POWer:[LEVEL][:IMMediate]:OFFSet	-100 ...+100 dB	dB	
[SOURce:]POWer:[LEVEL][:IMMediate]:RCL	INCLlude | EXCLude		
[SOURce:]POWer:LIMit[:AMPLitude]	<numeric_value>	dBm	
[SOURce:]POWer:MANual	<numeric_value>	dBm	
[SOURce:]POWer:MODE	FIXed|CW | SWEep		
[SOURce:]POWer:STARt	<numeric_value>	dBm	
[SOURce:]POWer:STOP	<numeric_value>	dBm	
[SOURce:]POWer:STEP[:INCRement]	0 ...100 dB	dB	
[SOURce:]POWer:STEP:MODE	USER | DECimal		

[SOURce:]POWer:ALC:OMODe SHOLd

The command sets the level control mode which becomes active when automatic level control is deactivated **(ALC OFF)**.

Parameter: **SHOLd**
Level control is activated briefly if the level or frequency changes (**ALC OFF Sample & Hold**).

Example:
```
POW:ALC OFF
```
'deactivates automatic level control.
```
POW:ALC:OMOD SHOL
```
'level control is briefly activated if the frequency or level changes.

*RST value	Resolution	Options	SCPI
SHOLd			Device-specific

[SOURce:]POWer:ALC:SONCe

The command briefly activates level control for correction purposes.

The command triggers an event and therefore has no *RST value and no query form.

Example: `POW:ALC OFF`
'deactivates automatic level control.

`POW:ALC:SONC`
'level control is performed once only.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]POWer:ALC[:STATe] ON | OFF | AUTO

The command activates/deactivates automatic level control.

Parameters: **ON**
internal level control is permanently activated.

OFF
internal level control is deactivated, Sample & Hold mode is activated.

AUTO
internal level control is activated/deactivated automatically depending on the operating state.

Example: `POW:ALC ON`
'activates automatic level control.

*RST value	Resolution	Options	SCPI
AUTO	-		Compliant

[SOURce:]POWer[:LEVel][:IMMediate][:AMPLitude] Minimum level ... Maximal level

The command sets the RF output level in CW mode. In addition to numerical values, it is also possible to specify `UP` and `DOWN`. The level is then increased or decreased by the value specified under `[SOURce:]POWer:STEP`.

As with the **Level** value entered in the header, the `Offset` value is also taken into consideration with this command.

The specified value range is therefore only effective if `:SOURce:POWer:Offset` is set to 0. The value range for other `Offset` values can be calculated using the following formula:

Minimum level + `Offset` ...Maximum level + `Offset`

The keywords of this command are largely optional. Therefore, both the long and short form of the command are shown in the example.

Parameters: **Minimum level ... Maximum level**
The value range for the level setting varies according to the instrument model. The values are given in the data sheet.

Example: `SOUR:POW:LEV:IMM:AMPL 15 or :POW 15`
'sets the RF level at output A to 15 dBm.

*RST value	Resolution	Options	SCPI
-30 dBm	0.01 dB		Compliant

[SOURce:]POWer[:LEVel][:IMMediate]:OFFSet -100 dB ... +100 dB

Caution:
The level offset is also effective for level sweeps!

The command specifies the constant level offset of a downstream attenuator/amplifier. If a level offset is entered, the level entered with `:POWer` no longer corresponds to the RF output level. The following correlation applies:

`:POWer` = RF output level + `POWer:Offset`.

Entering a level offset does not change the RF output level, but rather the query value of `:POWer`.

Only dB is permitted as the unit here. The linear units (V, W, etc.) are not permitted.

The keywords of this command are largely optional. Therefore, both the long and short form of the command are shown in the example.

Example: `SOUR:POW:LEV:IMM:Off -10`

or

`POW:OFFS 10`
'sets the RF level offset to 10 dB.

*RST value	Resolution	Options	SCPI
0 dB	0.01 dB		Compliant

[SOURce:]POWer[:LEVel][:IMMediate]:RCL INCLude | EXCLude

The command determines whether the current level is retained or whether the stored level setting is adopted when an instrument configuration is loaded.

*RST does not affect this setting.

Parameters: **INCLude**
The stored level is also loaded when a stored instrument configuration is loaded.

EXCLude
The RF level is not loaded when a stored instrument configuration is loaded. The current level is retained.

Example: `POW:RCL INCL`
'the stored level is set if the Recall command is called'.

*RST value	Resolution	Options	SCPI
-	-		Compliant

[SOURce:]POWer:LIMit[:AMPLitude] Minimum level .... Maximum level

The command limits the maximum RF output level in CW and SWEEP mode. It does not influence the LEVEL display or the response to the `POW?` query command.

Parameters: **Minimum level ... Maximum level**
The value range for the level setting varies according to the instrument model. The values are given in the data sheet.

Example: `SOURce:POWer:LIMit:AMPLitude 10 or :POW:LIM 10`
'limits the RF level to maximum +10 dBm.

*RST value	Resolution	Options	SCPI
+30 dBm	0.01 dB		Compliant

[SOURce:]POWer:MANual Minimum level ... Maximum level

In Sweep mode (`:SOUR:POW:MODE SWE`) the command sets the level for the next sweep step in the **Step** sweep mode (`:SOUR:SWE:POW:MODE MAN`). Here only level values between the settings `[:SOUR]:POW:STAR` and `...:STOP` are permitted. Each sweep step is triggered by a separate `:SOUR:POW:MAN` command.

As with the **Level** value entered in the **RF Level** menu, the `Offset` value is also taken into consideration with this command.

The specified value range is therefore only effective if `:SOURce:POWer:Offset` is set to 0. The value range for other `Offset` values can be calculated using the following formula:

Minimum level + `Offset` ... Maximum level + `Offset`

Parameters: **Minimum level ... Maximum level**
The value range for the level setting varies according to the instrument model. The values are given in the data sheet.c

Example: `POW:SWE:MODE MAN`
'sets the **Step** sweep mode.

`POW:MAN -5 dBm`
'sets an RF level of -5 dBm for the next setting in the **Step** sweep mode.

`POW:MODE SWE`
'sets the Level Sweep mode.

`POW:MAN -5.5 dBm`
'triggers the next sweep step with a level of -5.5 dBm.

*RST value	Resolution	Options	SCPI
-30 dBm	0.01 dBm		Compliant

[SOURce:]POWer:MODE CW|FIXed | SWEep

The command sets the instrument operating mode and therefore also the commands used to set the output level.

Parameters:

CW|FIXed
The instrument operates at a constant level. CW and FIXed are synonyms. The output level is set with `:SOURce:POWer`.

SWEep
The instrument operates in SWEep mode. The level is set using the commands `SOURce:POWer:STARt; STOP; MANual`.

Example: `POW:MODE SWEep`
'sets the SWEep mode. The settings under `SOURce:POW:STARt; STOP; MANual` become effective.

*RST value	Resolution	Options	Correlation	SCPI
CW	-			Compliant

[SOURce:]POWer:STARt Minimum level ... Maximum level

The command sets the RF start level in Sweep mode.

As with the **Level** value entered in the **RF Level** menu, the `Offset` value is also taken into consideration with this command.

The specified value range is therefore only effective if `:SOURce:POWer:Offset` is set to 0. The value range for other `Offset` values can be calculated using the following formula:

Minimum level + `Offset` ...Maximum level + `Offset`

Parameters:

Minimum level ... Maximum level
The value range for the level setting varies according to the instrument model. The values are given in the data sheet.

Example: `POW:STAR -20 dBm`
'sets the start level for the level sweep to -15 dBm.

*RST value	Resolution	Options	SCPI
-30 dBm	0.01 dB		Compliant

[SOURce:]POWer:STEP[:INCRement] 0 dB ... 100dB

The command sets the step width for the level setting if `UP` and `DOWN` are used as the level values and variation mode `:SOUR:POW:STEP:MODE USER` is selected. The command is linked to setting **Variation Step** for manual control, i.e. the command also sets the step width of the rotary knob for **Variation Active on**.

Example: `SOURce:POWer:STEP:INCRement 2` or `POW:STEP 2`
'sets the step width for entering the RF level to 2 dB.

*RST value	Resolution	Options	SCPI
1 dB	0.01 dB		Device-specific

[SOURce:]POWer:STEP:MODE USER | DECimal

This command activates (`USER`) or deactivates (`DECimal`) the user-defined step width used when varying the level value with the level values `UP/DOWN`. The command is linked to setting **Variation Active** for manual control, i.e. the command also activates/deactivates the user-defined step width used when varying the level value with the rotary knob.

Example: `POW:STEP 2`
'sets the step width for the level setting to 2 dB'.

`POW:STEP:MODE USER`
'actives this step width for level variation with the rotary knob (manual control) and with level values `UP/DOWN` (remote control)'.

*RST value	Resolution	Options	SCPI
DECimal	-		Device-specific

[SOURce:]POWer:STOP Minimum level ... Maximum level

The command sets the stop level in Sweep mode.

As with the **Level** value entered in the **RF Level** menu, the `Offset` value is also taken into consideration with this command.

The specified value range is therefore only effective if `:SOURce:POWer:Offset` is set to 0. The value range for other `Offset` values can be calculated using the following formula:

Minimum level + `Offset` ...Maximum level + `Offset`

Parameters: **Minimum level ... Maximum level**
The value range for the level setting varies according to the instrument model. The values are given in the data sheet.

Example: `POW:STOP 3`
'sets the stop level for the level sweep to 3 dBm.

*RST value	Resolution	Options	SCPI
-10 dBm	0.01 dB		Compliant

SOURce:PULM and PGEN Subsystem

The PULM subsystem contains the commands for checking the pulse modulation. The external signal is input at the **PULSE EXT** connector. The connector can be used as trigger input for internal pulse modulation. The polarity of the connector can be selected.

The PGEN Subsystem contains the command for activating/deactivating the output of the video/sync signal at the **PULSE VIDEO** connector.

The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]PGEN:STATe	ON | OFF		
[SOURce:]PULM:DELay	20ns .. 1s	**s**	
[SOURce:]PULM:DOUBle:DELay	20ns .. 1s	**s**	
[SOURce:]PULM:DOUBle:STATe	ON | OFF		
[SOURce:]PULM:DOUBle:WIDTh	20ns .. 1s		
[SOURce:]PULM:MODE	DOUBle | SINGle		
[SOURce:]PULM:PERiod	5µs .. 85.s | 100ns .. 85 s		
[SOURce:]PULM:POLarity	NORMal | INVerted		
[SOURce:]PULM:SOURce	INT | EXT		
[SOURce:]PULM:STATe	ON | OFF		
[SOURce:]PULM:TRIGger:EXTernal:SLOPe	POSitive | NEGative		
[SOURce:]PULM:TRIGger:EXTernal:GATE:POLarity	NORMal | INVerted		
[SOURce:]PULM:TRIGger:MODE	AUTO | EXTernal | EGATe		
[SOURce:]PULM:WIDTh	20ns .. 1s	**s**	

[SOURce:]PGEN:STATe ON | OFF

The command switches ON/OFF the output of the video/sync signal at the PULSE VIDEO connector at the rear of the instrument.

Example: `PGEN:STAT OFF`
'deactivates output of video/sync signal

*RST value	Resolution	Options	SCPI
OFF	-		Compliant

[SOURce:]PULM:DELay 20ns .. 1s

The command sets the pulse delay. The pulse delay determines the time that elapses after a trigger event before pulse modulation starts. The pulse delay is not effective for double pulse generation.

Example: `PULM:DEL 13 us`
'13 us elapse after a trigger before the first pulse is generated.

*RST value	Resolution	Options	SCPI
20 ns	20 ns		Device-specific

[SOURce:]PULM:DOUBle:DELay 20ns .. 1s

The command sets the delay from the start of the first pulse to the start of the second pulse.

Example: `PULM:DOUB:DEL 22 us`
'22 us elapse between the beginning of the first pulse and the beginning of the second pulse in double-pulse mode.

*RST value	Resolution	Options	SCPI
1 ms	20 ns		Device-specific

[SOURce:]PULM:DOUBle:STATe ON | OFF

The command enables/disables double pulse generation. The two pulses are generated in one pulse period.

Example: `PULM:DOUB:STAT ON`
'double-pulse mode is enabled.

*RST value	Resolution	Options	SCPI
OFF			Device-specific

[SOURce:]PULM:DOUBle:WIDTh 20ns .. 1s

The command sets the width of the second pulse in case of double pulse generation.

Example: `PULM:DOUB:WIDT 33 us`
'sets a width of 33 us for the second pulse.

*RST value	Resolution	Options	SCPI
1ms	20 ns		Device-specific

[SOURce:]PULM:MODE DOUBle | SINGle

The command selects the mode for pulse generation.

Parameters:

SINGle
A single pulse is generated in one pulse period.

DOUBle
Two pulses are generated in one pulse period.

Example:
```
PULM:MODE DOUB
```
'double-pulse mode is enabled.

*RST value	Resolution	Options	SCPI
SINGle			Device-specific

[SOURce:]PULM:PERiod 5µs .. 85.s | 100ns .. 85 s

The command sets the period of the generated pulse. The period determines the repetition frequency of the internal signal.

Example:
```
PULM:PER 220 us
```
'the pulse period is 220 us.

*RST value	Resolution	Options	SCPI
1 ms	1us | 20 ns		Device-specific

[SOURce:]PULM:POLarity NORMal | INVerted

The command sets the polarity between modulating and modulated signal. This command is only effective for an external modulation signal.

Parameters:

NORMal
The RF signal is suppressed during the pulse pause.

INVerted
The RF signal is suppressed during the pulse.

Example:
```
PULM:SOUR EXT
```
'selects the external modulation source.

```
PULM:POL INV
```
'selects inverted polarity.

*RST value	Resolution	Options	SCPI
NORMal	-		Device-specific

[SOURce:]PULM:SOURce INTernal | EXTernal

The command selects the source for pulse modulation. Pulse"

Parameters: **INTernal**
The internally generated rectangular signal is used for the pulse modulation.

EXTernal
The signal applied externally via the **PULS EXT** connector is used for the pulse modulation.

Example: `PULM:SOUR INT`
'selects the internal modulation source.

`PULM:STAT ON`
'activates the pulse modulation.

*RST value	Resolution	Options	SCPI
INTernal	-		Compliant

[SOURce:]PULM:STATe ON | OFF

The command activates/deactivates the pulse modulation. The pulse generator and the output of the video/sync signal is activated automatically. Output of signal can be switched off with command `SOURce:PGEN:OUTPut:STATe OFF`.

Example: `PULM:STAT ON`
'activates pulse modulation with the modulation source selected under `SOURce:PULM:SOURce`.

*RST value	Resolution	Options	SCPI
OFF	-		Compliant

[SOURce:]PULM:TRIGger:EXTernal:SLOPe POSitive | NEGative

The command sets the polarity of the active slope of an applied trigger at the PULSE EXT connector.

Example: `PULM:TRIG:EXT:SLOP NEG`
'the pulse generator is triggered on the negative slope of the external trigger signal.

*RST value	Resolution	Options	SCPI
POSitive	-		Device-specific

[SOURce:]PULM:TRIGger:EXTernal:GATe:POLarity NORMal | INVerted

Selects the polarity of the Gate signal. The signal is supplied via the PULSE EXT connector.

Example: `PULM:TRIG:EXT:GAT:POL NORM`
'The pulse signal is generated while the gate signal is high.

*RST value	Resolution	Options	SCPI
NORMal	-		Device-specific

[SOURce:]PULM:TRIGger:MODE AUTO | EXTernal | EGATe

The command selects the trigger mode for pulse modulation.

Parameters:

AUTO
The pulse modulation is generated continuously.

EXTernal
The pulse modulation is triggered by an external trigger event. The trigger signal is supplied via the PULSE EXT connector.

EGATe
The pulse modulation is gated by an external gate signal. The signal is supplied via the PULSE EXT connector.

Example: `PULM:TRIG:MODE EXT`
'selects triggering by an external trigger event. The trigger signal is supplied via the PULSE EXT connector.

*RST value	Resolution	Options	SCPI
AUTO	-		Compliant

[SOURce:]PULM:WIDTh 20ns .. 1s

The command sets the width of the generated pulse. The width determines the pulse length. The pulse width must be at least 20 ns less than the set pulse period.

Example: `PULM:WIDT 33 us`
'sets a width of 33 us for the pulse.

*RST value	Resolution	Options	SCPI
1ms	20 ns		Device-specific

SOURce:ROSCillator Subsystem

This subsystem contains the commands for setting the external and internal reference frequency.

Note:
*The commands of the SOURce:ROSCillator Subsystem are not affected by an instrument reset (*RST)*

Command	Parameters	Default unit	Remark
[SOURce:]ROSCillator:EXTernal:FREQuency	10 MHz	Hz	
[SOURce:]ROSCillator[:INTernal]:ADJust[:STATe]	ON | OFF		
[SOURce:]ROSCillator[:INTernal]:ADJust:VALue	0 ... 4095		
[SOURce:]ROSCillator:SOURce	INTernal | EXTernal		

[SOURce:]ROSCillator:EXTernal:FREQuency 10 MHz

The command informs the instrument of the frequency of the external reference (10 MHz).

Example:
```
ROSC:SOUR EXT
```
'selects the external source. The reference must be input at the REF IN input.
```
ROSC:EXT:FREQ 10 MHz
```
'informs the instrument that the external reference frequency is 10 MHz'.

*RST value	Resolution	Options	SCPI
-	-	-	Compliant

[SOURce:]ROSCillator[:INTernal]:ADJust[:STATe] ON | OFF

The command determines whether the calibrated (OFF) or a user-defined (ON) adjustment value is used for fine adjustment of the frequency. With STATe ON, the instrument is no longer in the calibrated state. However, the calibration value is not changed and the instrument resumes the calibrated state after switching the Adjustment State to `OFF`.

Example:
```
ROSC:SOUR INT
```
'selects the internal source.
```
ROSC:ADJ ON
```
'activates use of a user-defined adjustment value.
```
ROSC:ADJ:VAL 1400
```
'sets the adjustment value to 1400.

*RST value	Resolution	Options	SCPI
-	-	-.	Device-specific

[SOURce:]ROSCillator[:INTernal]:ADJust:VALue 0 ... 4095

The command specifies the frequency correction value (adjustment value).

Example: `ROSC:ADJ:VAL 1400`
'sets the adjustment value to 1400.

*RST value	Resolution	Options	SCPI
-	1		Device-specific

[SOURce:]ROSCillator:SOURce INTernal | EXTernal

The command selects between internal and external reference frequency.

Parameters:

INTernal
The internal reference oscillator is used. The reference signal is provided at the REF OUT connector.

EXTernal
An external reference signal is used. It must have a frequency of 10 MHz and must be input at the REF IN connector at the rear of the instrument.

Example: `ROSC:SOUR EXT`
'selects the external source.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

SOURce:SWEep Subsystem

This subsystem contains the commands for checking the RF sweeps, i.e. the sweeps of the RF generators. Sweeps are always triggered, except for the `MANual` sweep mode. The frequency sweep is activated by the command `SOURce:FREQuency:MODE SWEep`, and the level sweep by the command `SOURce:POWer:MODE SWEep`. All sweeps, including the LF sweep, can be set independently of each other.

The keyword SOURce is optional with commands and can be omitted.

A sweep is set in several steps which are shown below taking a frequency sweep as an example:

1. Set the sweep range.
```
[SOURce:]FREQuency:CENTer 200 MHz
[SOURce:]FREQuency:SPAN 300 MHz
```

2. Select linear or logarithmic spacing.
```
[SOURce:]SWEep[:FREQuency]:SPACing LIN
```

3. Set the step width and dwell time.
```
[SOURce:]SWEep[:FREQuency]:STEP:LINear 20 MHz
[SOURce:]SWEep[:FREQuency]:DWELl 12 ms
```

4. Select the trigger mode.
   `TRIGger:FSWeep:SOURce SINGle`

5. Select the sweep mode and activate the sweep.
   `[SOURce:]SWEep[:FREQuency]:MODE AUTO`
   `[SOURce:]FREQuency:MODE  SWEep`

6. Trigger the sweep.
   `[SOURce:]SWEep[:FREQuency]:EXECute`

Note:
It is recommended to switch off the GUI update for optimum sweep performance especially with short dwell times (SYSTem:DISPlay:UPDate OFF).

Command	Parameters	Default unit	Remark
[SOURce:]SWEep[:FREQuency]:DWELl	2 ms ... 10 s	s	
[SOURce:]SWEep[:FREQuency]:EXECute	-		
[SOURce:]SWEep[:FREQuency]:MODE	AUTO | MANual | STEP		
[SOURce:]SWEep[FREQuency]:POINts	<numeric_value>		
[SOURce:]SWEep[:FREQuency]:SHAPe	SAWTooth |TRIangle		
[SOURce:]SWEep[:FREQuency]:SPACing	LINear | LOGarithmic		
[SOURce:]SWEep[:FREQuency]:STEP[:LINear]	0 ... (STOP - STARt)	Hz	
[SOURce:]SWEep[:FREQuency]:STEP:LOGarithmic	0.01 ... 9999 PCT		
[SOURce:]SWEep:POWer:DWELl	2 ms...10 s	s	
[SOURce:]SWEep:POWer:EXECute	-		
[SOURce:]SWEep:POWer:MODE	AUTO | MANual | STEP		
[SOURce:]SWEep:POWer:POINts	<numeric_value>		
[SOURce:]SWEep:POWer:SHAPe	SAWTooth |TRIangle		
[SOURce:]SWEep:POWer:SPACing:MODE			Query only
[SOURce:]SWEep:POWer:STEP:[:LOGarithmic]	0.1 ...20 dB		
[SOURce:]SWEep:RESet[:ALL]			No query

[SOURce:]SWEep[:FREQuency]:DWELl 3 ms...10 s

The command sets the time taken for each frequency step of the sweep.

Note:
It is recommended to switch off the GUI update for optimum sweep performance especially with short dwell times (SYSTem:DISPlay:UPDate OFF).

The keyword `[:FREQuency]` can be omitted (see example). The command is then SCPI-compliant.

Example: `SWE:DWEL 12 ms`
'sets a dwell time of 12 ms for a frequency sweep.

*RST value	Resolution	Options	SCPI
10 ms	0.1 ms		Device-specific

[SOURce:]SWEep[:FREQuency]:EXECute

The command triggers a sweep. The command is only valid for sweep mode Single (`SOURce:SWEep:FREQuency:MODE SINGle`). The command corresponds to the manual-control command EXECUTE SINGLE SWEEP.

The command triggers an event and therefore has no query form and no *RST value.

Example: `SWE:FREQ:MODE SING`
'sets the single cycle mode of the frequency sweep.

`SWE:FREQ:EXEC`
'triggers a single frequency sweep.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]SWEep[:FREQuency]:MODE AUTO | MANual | STEP

The command sets the sweep mode.

The keyword `[:FREQuency]` can be omitted (see example). The command is then SCPI-compliant.

Parameters:

AUTO
Each trigger triggers exactly one complete sweep.

MANual
The trigger system is not active. Each frequency step of the sweep is triggered individually, either by varying the **Current Frequency** value using the rotary knob under manual control or by means of a `FREQ:MAN` command under remote control. With manual control, the frequency increases or decreases (depending on the direction of the rotary encoder) by the value specified under `SOUR:SWE:FREQ:STEP:LIN` (linear spacing) or `...:STEP:LOG` (logarithmic spacing). With remote control, the frequency increases by the value specified under `SWEep:FREQ:STEP:LIN|LOG` which each sent `:FREQ:MAN` command, irrespective the value entered there.

STEP
Each external trigger triggers one sweep step only (**Mode Extern Step**). The frequency increases by the value entered under `SOUR:SWE:FREQ:STEP:LIN` (linear spacing) or `...:STEP:LOG` (logarithmic spacing).

Example:

```
SWE:MODE AUTO
```
'selects auto mode for a frequency sweep.

*RST value	Resolution	Options	SCPI
AUTO	-		Device-specific

[SOURce:]SWEep[:FREQuency]:POINts <numeric_value>

The command sets the number of steps in an RF sweep. The command is linked to the command `:SWEep[:FREQuency]:STEP` as follows:

The following applies for linear sweeps: `POINts = (SPAN / STEP:LIN) + 1`

The following applies for logarithmic sweeps and `STARt < STOP`:

`POINts = ((log STOP - log STARt) / log STEP:LOG) + 1`

If `POINTs` changes, the value of `STEP` is adjusted. The `STARt` and `STOP` value is retained.

Two separate POINts values are used for linear or logarithmic sweep spacing (`:SWEep[:FREQuency]:SPACing LIN | LOG`). The command is always effective for the currently set sweep spacing.

Example:

```
FREQ:STAR
```
'sets the start frequency to 100 MHz.

```
FREQ:STOP
```
'sets the stop frequency to 500 MHz.

```
SWE:SPAC LIN
```
'sets linear sweep spacing.

```
SWE:POIN 401
```
'sets 401 sweep steps for linear sweep spacing. The sweep step width (`STEP`) is automatically set to 1 MHz.

*RST value	Resolution	Options	Correlation	SCPI
	-		The value of `:SWE:STEP` is adjusted automatically.	Device-specific (adapted to instrument properties)

[SOURce:]SWEep[:FREQuency]:SHAPe SAWTooth | TRIangle

The command sets the cycle mode for a sweep sequence (shape).

Parameters:

SAWTooth
One sweep runs from start to stop frequency. Each subsequent sweep starts at the start frequency, i.e. the shape of the sweep sequence resembles a sawtooth.

TRIangle
One sweep runs from start to stop frequency and back,i.e. the shape of the sweep resembles a triangle. Each subsequent sweep starts at the start frequency.

Example:

```
SOUR:SWE:SHAP TRI
```
'selects the sweep cycle with alternating sweep directions.

*RST value	Resolution	Options	SCPI
SAWTooth	-		Device-specific

[SOURce:]SWEep[:FREQuency]:SPACing LINear | LOGarithmic

The command selects linear or logarithmic sweep spacing.

The keyword `[:FREQuency]` can be omitted (see example). The command is then SCPI-compliant.

Example: `SWE:SPAC LIN`
'selects linear sweep spacing for a frequency sweep.

*RST value	Resolution	Options	SCPI
LIN	-		Device-specific

[SOURce:]SWEep[:FREQuency]:STEP[:LINear] 0 ... (STOP - STARt)

The command sets the step width for linear sweeps.

This command is linked to the command `:SWEep[:FREQuency]:POINts` as follows:

`POINts = (SPAN / STEP:LIN) + 1`

If `STEP:LIN` changes, the value of `POINTs` is adjusted. The `STARt` and `STOP` value is retained.

The keywords `[:FREQuency]` and `[:LINear]` can be omitted (see example). The command is then SCPI-compliant.

Example: `FREQ:STAR`
'sets the start frequency to 100 MHz.

`FREQ:STOP`
'sets the stop frequency to 500 MHz.

`SWE:SPAC LIN`
'sets linear sweep spacing.

`SWE:STEP 2 MHz`
'sets the step width for linear sweep spacing to 2 MHz (RF sweep). The number of sweep steps for linear sweep spacing (`POINts`) is automatically set to 201.

*RST value	Resolution	Options	Correlation	SCPI
1 MHz	0.1 Hz.		The value of `:SWE:POINts` is adjusted automatically.	Device-specific

[SOURce:]SWEep[:FREQuency]:STEP:LOGarithmic 0.01 ... 9999 PCT

The command specifies the step width factor for logarithmic sweeps. The next frequency value of a sweep is calculated (for STARt < STOP) using the following formula:

New frequency = Old frequency + STEP:LOG x Old frequency

STEP:LOG therefore gives the fraction of the old frequency. The frequency is increased by this fraction for the next sweep step. Usually STEP:LOG is given in percent, whereby the suffix PCT must always be used.

The command is linked to the command :SWEep[:FREQuency]:POINts for STARt < STOP as follows:

```
POINts = ((log STOP - log STARt) / log STEP:LOG) + 1
```

If STEP:LOG changes, the value of POINTs is adjusted. The STARt and STOP value is retained.

Example:

```
FREQ:STAR
```
'sets the start frequency to 100 MHz.

```
FREQ:STOP
```
'sets the stop frequency to 500 MHz.

```
SWE:SPAC LOG
```
'sets logarithmic sweep spacing.

```
SWE:STEP:LOG 10PCT
```
'sets the step width for logarithmic sweep spacing to 10% of the previous frequency in each instance (for a frequency sweep).

*RST value	Resolution	Options	Correlation	SCPI
1 PCT	0.01 PCT		The value of :SWE:POIN is adjusted automatically.	Device-specific

[SOURce:]SWEep:POWer:DWELl 2 ms...10 s

The command sets the time taken for each level step of the sweep.

Note:
It is recommended to switch off the GUI update for optimum sweep performance especially with short dwell times (SYSTem:DISPlay:UPDate OFF).

Example:

```
SWE:POW:DWEL 12 m
```
'sets a dwell time of 12 ms for a level sweep.

*RST value	Resolution	Options	SCPI
10 ms	0.1 ms		Device-specific

[SOURce:]SWEep:POWer:EXECute

The command triggers a sweep.The command is only valid for sweep mode Single (`SOURce:SWEep:POWer:MODE SINGle`). The command corresponds to the manual-control command EXECUTE SINGLE SWEEP.

The command triggers an event and therefore has no query form and no *RST value.

Example:
```
SWE:POW:MODE SING
'sets the single cycle mode of the level sweep.
SWE:POW:EXEC
'triggers a level sweep.
```

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]SWEep:POWer:MODE AUTO | MANual | STEP

The command sets the cycle mode of the level sweep.

Parameters:

AUTO
Each trigger triggers exactly one complete sweep.

MANual
The trigger system is not active. Each level step of the sweep is triggered individually, either by varying the **Current Level** value using the rotary knob under manual control or by means of a `POW:MAN` command under remote control. With manual control, the level increases or decreases (depending on the direction of the rotary encoder) by the value specified under `SOUR:SWE:POW:STEP`. With remote control, the level increases by the value specified under `SWEep:POW:STEP` which each sent `:POW:MAN` command, irrespective the value entered there.

STEP
Each external trigger triggers one sweep step only (**Mode Extern Step**). The level increases by the value entered under `:SWEep:POWer:STEP`.

Example:
```
SWE:POW:MODE AUTO
'selects Mode Auto for a level sweep.
```

*RST value	Resolution	Options	SCPI
AUTO	-		Device-specific

[SOURce:]SWEep:POWer:POINts <numeric_value>

The command sets the number of steps in a level sweep. The command is linked to the command `:SWEep:POWer:STEP` as follows:

`POINts = ((STOP - STARt) / STEP:LOG) + 1`

If `POINTs` changes, the value of `STEP` is adjusted. The `STARt` and `STOP` value is retained.

Example: `POW:STAR - 30 dBm`
'sets the start frequency to -30 dBm.

`POW:STOP - 10 dBm`
'sets the stop frequency to -10 dBm.

`SWE:POW:POIN 20`
'sets 20 sweep steps. The sweep step width (`STEP`) is automatically set to 1 dB.'

*RST value	Resolution	Options	Correlation	SCPI
20 dB	-		The value of `:SWE:POW:STEP` is adjusted automatically.	Device-specific (adapted to instrument properties)

[SOURce:]SWEep:POWer:SHAPe SAWTooth | TRIangle

The command sets the cycle mode for a sweep sequence (shape).

Parameters:

SAWTooth
One sweep runs from the start level to the stop level. The subsequent sweep starts at the start level again, i.e. the shape of sweep sequence resembles a sawtooth.

TRIangle
One sweep runs from start to stop level and back, i.e. the shape of the sweep resembles a triangle.Each subsequent sweep starts at the start level again.

Example: `SOUR:SWE:POW:SHAP TRI`
'selects the sweep cycle with alternating ascending and descending sweep directions.

*RST value	Resolution	Options	SCPI
SAWTooth	-		Device-specific

[SOURce:]SWEep:POWer:SPACing:MODE?

The command queries the sweep spacing. The sweep spacing for level sweeps is always linear.

This command is a query command and has no *RST value.

Example: `SWE:POW:SPAC:MODE?`
'queries the sweep spacing for a level sweep.

Result: `LIN`
'linear spacing.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]SWEep:POWer:STEP[:LOGarithmic] 0.01 ... 165 dB

The command sets the step width factor for logarithmic sweeps. The next level value of a sweep is calculated (for `STARt` < `STOP`) using the following formula:

New level = Old level + `STEP:LOG` x Old level

`STEP:LOG` therefore gives the fraction of the old level. The level is increased by this fraction for the next sweep step. Usually `STEP:LOG` is given in decibels, whereby the suffix `dB` must always be used.

The command is linked to the command `:SWEep:POWer:POINts` for `STARt` < `STOP` as follows:

```
POINts = ((STOP - STARt) / STEP:LOG) + 1
```

If `STEP:LOG` changes, the value of `POINTs` is adjusted. The `STARt` and `STOP` value is retained.

Example:
```
SWE:POW:STEP 10dB
```
'sets the step width for logarithmic sweep spacing to 10 dB of the previous level in each instance (for a level sweep).

*RST value	Resolution	Options	SCPI
1 dB	0.01 dB		Device-specific

[SOURce:]SWEep:RESet[:ALL]

The command resets all active sweeps to the starting point.

The command triggers an event and therefore has no reset value.

Example:
```
SWE:RES
```
'resets all active sweeps to the starting point.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

STATus Subsystem

This system contains the commands for the status reporting system. *RST has no effect on the status registers.

Queries return the current value of the respective register, which permits a check of the device status. A decimal value between 0 and 32767 (=2^{15}-1) is returned.

The configuration commands set the respective register thus determining which status changes of the R&S Signal Generator causes the status registers to be changed. A decimal value between 0 and 32767 (= 2^15-1) is set.

Command	Parameters	Default unit	Remark
STATus:OPERation:CONDition?			Query only
STATus:OPERation:ENABle	0...32767		
STATus:OPERation[:EVENt]?			Query only
STATus:OPERation:NTRansition	0...32767		
STATus:OPERation:PTRansition	0...32767		
STATus:PRESet			No query
STATus:QUEStionable:CONDition?			Query only
STATus:QUEStionable:ENABle	0...32767		
STATus:QUEStionable[:EVENt]?			Query only
STATus:QUEStionable:NTRansition	0...32767		
STATus:QUEStionable:PTRansition	0...32767		
STATus:QUEue[:NEXT]?			Query only

STATus:OPERation:EVENt?

The command queries the content of the EVENt part of the STATus:OPERation register. This part contains information on the actions performed in the instrument since the last readout. The content of the EVENt part is deleted after being read out.

Example: `STAT:OPER:EVEN?`
'queries the STATus:OPERation:EVENt register.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:OPERation:CONDition?

The command queries the content of the CONDition part of the STATus:OPERation register. This part contains information on the action currently being performed in the instrument. The content is not deleted after being read out since it indicates the current hardware status.

Example: `STAT:OPER:COND?`
'queries the Status:Operation:Condition register.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:OPERation:PTRansition

The command sets the bits of the PTRansition part of the STATus:OPERation register. If a bit is set, a transition from 0 to 1 in the condition part causes an entry to be made in the EVENt part of the register. A new event in the hardware is thus registered, e.g. the start of an adjustment.

Example: `STAT:OPER:PTR 32767`
'all transitions from 0 to 1 in the condition part of the Status:Operation register cause an entry to be made in the EVENt part.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:OPERation:NTRansition

The command sets the bits of the NTRansition part of the STATus:OPERation register. If a bit is set, a transition from 1 to 0 in the condition part causes an entry to be made in the EVENt part of the register. The disappearance of an event in the hardware is thus registered, e.g. the end of an adjustment.

Example: `STAT:OPER:NTR 0`
'a transition from 1 to 0 in the condition part of the Status:Operation register does not cause an entry to be made in the EVENt part.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:OPERation:ENABle

The command sets the bits of the ENABle part of the STATus:OPERation register. This setting determines which events of the Status-Event part are forwarded to the sum bit in the status byte. These events can be used for a service request.

Example: `STAT:OPER:ENAB 32767`
'all events are forwarded to the sum bit of the status byte.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:PRESet

The command resets the status registers. All PTRansition parts are set to FFFFH (32767), i.e. all transitions from 0 to 1 are detected. All NTRansition parts are set to 0, i.e. a transition from 1 to 0 in a CONDition bit is not detected. The ENABle parts of STATus:OPERation and STATus:QUEStionable are set to 0, i.e. all events in these registers are not passed on.

The command triggers an event and therefore has no query form and no *RST value.

Example: `STAT:PRES`
'resets the status registers.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:QUEStionable:EVENt?

The command queries the content of the EVENt part of the STATus:QUEStionable register. This part contains information on the actions performed in the instrument since the last readout. The content of the EVENt part is deleted after being read out.

Example: `STAT:OPER:EVEN?`
'queries the Status:Questionable:Event register.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:QUEStionable:CONDition?

The command queries the content of the CONDition part of the STATus:QUEStionable register. This part contains information on the action currently being performed in the instrument. The content is not deleted after being read out since it indicates the current hardware status.

Example: `STAT:OPER:COND?`
'queries the Status:Questionable:Condition register.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:QUEStionable:PTRansition

The command sets the bits of the PTRansition part of the STATus:QUEStionable register. If a bit is set, a transition from 0 to 1 in the condition part causes an entry to be made in the EVENt part of the register.

Example: `STAT:OPER:PTR 32767`
'all transitions from 0 to 1 in the condition part of the Status:Questionable register cause an entry to be made in the EVENt part.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:QUEStionable:NTRansition

The command sets the bits of the NTRansition part of the STATus:QUEStionable register. If a bit is set, a transition from 1 to 0 in the condition part causes an entry to be made in the EVENt part of the register.

Example: `STAT:OPER:NTR 0`
'a transition from 1 to 0 in the condition part of the Status:Questionable register does not cause an entry to be made in the EVENt part.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:QUEStionable:ENABle

The command sets the bits of the ENABle part of the STATus:QUEStionable register. This setting determines which events of the Status-Event part are enabled for the sum bit in the status byte. These events can be used for a service request.

Example: `STAT:OPER:ENAB 1`
'problems when performing an adjustment cause an entry to be made in the sum bit.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:QUEue[:NEXT]?

The command queries the oldest entry in the error queue and then deletes it. Positive error numbers denote device-specific errors, and negative error numbers denote error messages defined by SCPI (see Chapter 9). If the error queue is empty, 0 ("No error") is returned. The command is identical to `SYSTem:ERRor?`.

Example: `STAT:QUE?`
'queries the oldest entry in the error queue.

Response: "0, 'no error'"
'no errors have occurred since the error queue was last read out.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem Subsystem

The SYSTem subsystem contains a series of commands for general functions which do not directly affect signal generation.

Command	Parameters	Default unit	Remark
SYSTem:BEEPer:STATe	ON | OFF		
SYSTem:COMMunicate:GPIB:LTERminator	EOI | STANdard		
SYSTem:COMMunicate:GPIB[:SELF]:ADDRess	0...30		
SYSTem:COMMunicate:NETWork[:COMMon]:HOSTname	'string'		
SYSTem:COMMunicate:NETWork:COMMon:SET			No query
SYSTem:COMMunicate:NETWork:DNS:ALTernate	0.0.0.0		
SYSTem:COMMunicate:NETWork:DNS:MODE	STATic | AUTO		
SYSTem:COMMunicate:NETWork:DNS:PREFerred	0.0.0.0 ... FF.FF.FF.FF		
SYSTem:COMMunicate:NETWork:DNS:SET			No query
SYSTem:COMMunicate:NETWork:GET			No query
SYSTem:COMMunicate:NETWork:IPADdress	0.0.0.0 ... FF.FF.FF.FF		
SYSTem:COMMunicate:NETWork[:IPADdress]:GATeway	'string'		
SYSTem:COMMunicate:NETWork:IPADdress:MODE	STATic | P2P | AUTO		
SYSTem:COMMunicate:NETWork:IPADdress:SET			No query
SYSTem:COMMunicate:NETWork[:IPADdress]:SUBNet:MASK	0.0.0.0 .. FF.FF.FF.FF		
SYSTem:COMMunicate:NETWork:MACaddress			Query only
SYSTem:COMMunicate:NETWork:RESource			Query only
SYSTem:COMMunicate:USB:RESource			Query only
SYSTem:DATE	<year>,<month>,<day>		
SYSTem:DISPlay:UPDate	ON | OFF		
SYSTem:ERRor:ALL			Query only
SYSTem:ERRor:CODE:ALL			Query only
SYSTem:ERRor:CODE[:NEXT]?			Query only
SYSTem:ERRor:COUNt?			Query only
SYSTem:ERRor[:NEXT]?			Query only
SYSTem:FPReset			No query
SYSTem:KLOCk	ON | OFF		
SYSTem:LANGuage			Query only
SYSTem:PRESet			No query
SYSTem:PROTect<n>[:STATe]	ON | OFF , password		
SYSTem:SERRor?			Query only
SYSTem:STARtup:COMPlete			Query only
SYSTem:TIME	<hour>,<min>,<sec>		
SYSTem:VERSion?			Query only

SYSTem:BEEPer:STATe ON | OFF

The command switches the key beep on or off.

Example: `SYST:BEEP:STAT O`
'no acoustic signal is output when a key on the front panel is pressed.

*RST value	Resolution	Options	SCPI
OFF	-		Compliant

SYSTem:COMMunicate:GPIB:LTERminator EOI | STANdard

The command sets the terminator recognition for remote control via the IEC/IEEE bus.

Parameters:

EOI
The terminator must be sent together with the line message EOI (End of Line). This setting is recommended for binary block transmissions where a character could coincidentally have the value LF (Line Feed) but is not intended as the terminator. This setting must be selected for block data with undefined length.

STANdard
An LF (Line Feed) is recognized as the terminator regardless of whether it is sent with or without EOI.

Example: `SYST:COMM:GPIB:LTER EOI`
'only a character which is sent simultaneously with the line message EOI is accepted as the terminator.

*RST value	Resolution	Options	SCPI
STANdard	-		Compliant

SYSTem:COMMunicate:GPIB[:SELF]:ADDRess 1 ... 30

The command sets the IEC/IEEE-bus address.

Example: `SYST:COMM:GPIB:ADDR 14`
'sets IEC/IEEE-bus address 14.

*RST value	Resolution	Options	SCPI
28	-		Compliant

SYSTem:COMMunicate:NETWork[:COMMon]:HOSTname 'string'

The command enters the individual computer name of the R&S SMC. The entry is only activated after sending command `SYST:COMM:NETW:COMM:SET`.

Note:
The hostname can only be changed after deactivating protection level 1 (command `SYSTem:PROTect<n>:STATe OFF`*, password)*

Example: `SYST:COMM:NETW:HOST 'SMC'`
'enters the individual computer name of the R&S SMC

`SYST:COMM:NETW:COMM:SET ON`
'activates the change of the hostname.

*RST value	Resolution	Options	SCPI
	-		Device-specific

SYSTem:COMMunicate:NETWork:COMMon:SET

The command activates the hostname setting (Command `SYST:COMM:NETW:COMM:HOST`).

The command triggers an event and therefore has no *RST value and no query form.

Example: `SYST:COMM:NETW:COMM:SET`
'activates a change of the hostname.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork:DNS:ALTernate 0.0.0.0 .. FF.FF.FF.FF

The command sets the alternate DNS server address manually.

Example: `SYST:COMM:NETW:DNS:MODE STAT`
' the DNS server address is assigned manually.

`SYST:COMM:NETW:DNS:ALT 7.8.9.10`
'sets the IP address of the alternate DNS server

`SYST:COMM:NETW:COMM:SET ON`
'activates the above settings.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork:DNS:MODE STATic | AUTO

The command selects if the DNS server address is assigned automatically or manually. The entry is only activated after sending command `SYST:COMM:NETW:DNS:SET`.

Parameters:

AUTO
The DNS server address is assigned automatically. The network used must support automatic assignment of address (DHCP) in order to use this function.

STATic
The DNS server address is assigned manually.

Example:

```
SYST:COMM:NETW:DNS:MODE AUTO
' the DNS server address is assigned automatically (DHCP).
SYST:COMM:NETW:COMM:SET ON
'activates DHCP.
```

*RST value	Resolution	Options	SCPI
AUTO	-		Device-specific

SYSTem:COMMunicate:NETWork:DNS:PREFerred 0.0.0.0 .. FF.FF.FF.FF

The command sets the preferred DNS server address manually. The entry is only activated after sending command `SYST:COMM:NETW:DNS:SET`.

Example:

```
SYST:COMM:NETW:DNS:MODE STAT
' the DNS server address is assigned manually.
SYST:COMM:NETW:DNS:PREF 7.8.9.10
'sets the IP address of the preferred DNS server.
SYST:COMM:NETW:COMM:SET ON
'activates the above settings.
```

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork:DNS:SET

The command activates the DNS setting (Commands `SYST:COMM:NETW:DNS:..`).

The command triggers an event and therefore has no *RST value and no query form.

Example:

```
SYST:COMM:NETW:DNS:SET
'activates all changes of the DNS settings.
```

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork:GET

The command retrieves the current network settings. They can be queried with the corresponding commands.

The command triggers an event and therefore has no *RST value and no query form.

Example:
```
SYST:COMM:NETW:GET
' retrieves the current network settings.
```

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork:IPADdress 0.0.0.0 .. FF.FF.FF.FF

The command enters the IP address . The entry is only activated after sending command `SYST:COMM:NETW:IPAD:SET`.

Example:
```
SYST:COMM:NETW:IPAD  7.8.9.10
'enters the IP address of the R&S SMC.

SYST:COMM:NETW:IPAD:SET
'activates all changes of the IP address settings.
```

*RST value	Resolution	Options	SCPI
	-		Device-specific

SYSTem:COMMunicate:NETWork[:IPADdress]:GATeway 0.0.0.0 .. FF.FF.FF.FF

The command enters the IP address of the default gateway. The entry is only activated after sending command `SYST:COMM:NETW:IPAD:SET`.

Example:
```
SYST:COMM:NETW:GAT 1.2.3.4
'enters the IP address of the default gateway.

SYST:COMM:NETW:IPAD:SET
'activates all changes of the IP address settings.
```

*RST value	Resolution	Options	SCPI
28	-		Device-specific

SYSTem:COMMunicate:NETWork:IPADdress:MODE STATic | AUTO

The command selects if the IP address is assigned automatically or manually. The entry is only activated after sending command `SYST:COMM:NETW:IPAD:SET`.

Parameters:

AUTO
The IP address is assigned automatically. The network used must support automatic assignment of address (DHCP) in order to use this function.

STATic
The IP address is assigned manually.

P2P
A Peer to Peer connection is used.

Example:

```
SYST:COMM:NETW:IPAD:MODE AUTO
' the IP address is assigned automatically (DHCP).
SYST:COMM:NETW:IPAD:SET ON
'activates DHCP.
```

*RST value	Resolution	Options	SCPI
AUTO	-		Device-specific

SYSTem:COMMunicate:NETWork:IPADdress:SET

The command activates the IP settings (Commands `SYST:COMM:NETW:IPAD:..`).

The command triggers an event and therefore has no *RST value and no query form.

Example:

```
SYST:COMM:NETW:IPAD:SET
'activates all changes of the IP adress settings.
```

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork[:IPADdress]:SUBNet:MASK 0.0.0.0 .. FF.FF.FF.FF

The command enters the Subnet mask. The entry is only activated after sending command `SYST:COMM:NETW:IPAD:SET`.

Example:

```
SYST:COMM:NETW:SUBN:MASK 255.255.255.0
'enters the Subnet mask.
SYST:COMM:NETW:IPAD:SET
'activates all changes of the IP address settings.
```

*RST value	Resolution	Options	SCPI
	-		Device-specific

SYSTem:COMMunicate:MACaddress?

The command queries the MAC address of the network adapter.

The command is a query command and therefore has no *RST value.

Example: SYST:COMM:NETW:MAC?
'queries the MAC address.

*RST value	Resolution	Options	SCPI
	-		Device-specific

SYSTem:COMMunicate:NETWork:RESource?

The command queries the visa resource string. This string is used for remote control of the instrument.

The command is a query command and therefore has no *RST value.

Example: SYST:COMM:NETW:RES?
'queries the VISA resource string.

Response:
TCPIP::192.1.2.3::INSTR

*RST value	Resolution	Options	SCPI
	-		Device-specific

SYSTem:COMMunicate:USB:RESource?

The command queries the visa resource string for remote control via the USB interface. .

The command is a query command and therefore has no *RST value.

Example: SYST:COMM:USB:RES?
'queries the VISA resource string for remote control via the USB interface.

Response:
USB::72::000000::INSTR

*RST value	Resolution	Options	SCPI
	-		Device-specific

SYSTem:DATE <year>,<month>,<day>

The command sets the date for the instrument-internal calendar. "

Example: SYST:DATE 2003,05,01
'sets May 1, 2003.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:DISPlay:UPDate ON | OFF

The command switches the update of the display on/off. A switchover from remote control to manual control always sets the status of the update of the display to ON.

Example: `SYST:DISP:UPD OFF`
'switches update of displayed parameter values off.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:ERRor:ALL?

The command queries all entries in the error queue and then deletes them. Positive error numbers denote device-specific errors, and negative error numbers denote error messages defined by SCPI (see section "*Error Messages*"). If the error queue is empty, 0 ("No error") is returned.

The command is a query command and therefore has no *RST value.

Example: `SYST:ERR:ALL?`
'queries all entries in the error queue.

Response: "0, 'no error'"
'no errors have occurred since the error queue was last read out.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:FPReset

The command triggers an instrument reset to the original state of delivery. This includes also the parameters, that are unchanged when executing a regular Preset with the `*RST` command, e.g. IEC/IEEE bus address. However, password settings and all settings protected by these password are not changed, e.g. disabled USB connections, LAN settings and reference oscillator setting.

The command triggers an event and therefore has no *RST value and no query form.

Example: `SYST:FPR`
'all instrument settings (also those that are not currently active) are reset to the factory values.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:ERRor:CODE[:NEXT]?

The command queries the oldest entry in the error queue and then deletes it. Only the error number is returned and not the entire error text. Positive error numbers denote device-specific errors, and negative error numbers denote error messages defined by SCPI (see section "*Error Messages*"). If the error queue is empty, 0 is returned.

The command is a query command and therefore has no *RST value.

Example: `SYST:ERR:CODE?`
'queries the oldest entry in the error queue.

Response: "0"
'no errors have occurred since the error queue was last read out.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:ERRor:COUNt?

The command queries the number of entries in the error queue . If the error queue is empty, '0' is returned.

The command is a query command and therefore has no *RST value.

Example: `SYST:ERR:CODE?`
'queries the oldest entry in the error queue.

Response: "1"
'one error has occurred since the error queue was last read out.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:ERRor[:NEXT]?

The command queries the oldest entry in the error queue and then deletes it. Positive error numbers denote device-specific errors, and negative error numbers denote error messages defined by SCPI (see Chapter 9). If the error queue is empty, 0 ("No error") is returned. The command is identical to the command `STATus:QUEue:NEXT?`.

The command is a query command and therefore has no *RST value.

Example: `SYST:ERR?`
'queries the oldest entry in the error queue.

Response: "0, 'no error'"
'no errors have occurred since the error queue was last read out.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:KLOCk ON | OFF

The command (Keyboard LOCk) disables the front panel keyboard of the R&S Signal Generator including the LOCAL key, or enables it again (OFF).

Example: `SYST:KLOC ON`
'activates the keyboard lock. The keyboard cannot be operated again until it has been enabled with `SYST:KLOC OFF`.

*RST value	Resolution	Options	SCPI
OFF	-		Compliant

SYSTem - Language

SYSTem:LANGuage?

The command queries the remote control command set.

The command is a query and therefore has no *RST value.

Example: `SYST:LANG?`

Response `"SCPI"`
'the SCPI command set is used

*RST value	Resolution	Options	SCPI
-	-		Device specific

SYSTem:PRESet

The command triggers an instrument reset. It has the same effect as the PRESET key on the front panel and the *RST command.

The command triggers an event and therefore has no *RST value and no query form.

Example: `SYST:PRES`
'all instrument settings (also those that are not currently active) are reset to their default values.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:PROTect<n>[:STATe] ON | OFF, password

The command activates and deactivates the specified protection level. There are several protection levels which disable specific service functions (authorized personnel of R&S Service Departments only). These levels are identified by the suffix under PROTect.

The respective functions are disabled when the protection level is activated. No password is required for activation. A password must be entered to deactivate the protection level. The password for the first level is 123456. This protection level can be used to lock-out internal adjustments.

The command triggers an event and therefore has no *RST value and no query form.

Example:
```
SYST:PROT1 ON
```
'activates protection level 1. Internal adjustments are only possible after deactivating the lock-out.

```
SYST:PROT1 OFF, 123456
```
'deactivates protection level 1. Internal adjustments are enabled again.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:SERRor?

This command returns a list of all errors existing at the time when the query is started. This list corresponds to the display on the info page under manual control.

The command is a query command and therefore has no *RST value.

Example:
```
"SYST:SERR?"
```
'queries all errors existing in the error queue.

Response:

```
"-221, 'Settings conflict', 153, 'Input voltage out of range'"
```
'the two returned errors have occurred since the error queue was last queried.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:STARtup:COMPlete?

The command queries if the startup of the instrument is completed.

This command is a query and therefore has no *RST value.

Example:
```
SYST:STAR:COMP?
```

```
Response: 1
```
'the startup of the instrument is completed.

*RST value	Resolution	Options	SCPI
	-		

SYSTem:TIME 0...23,0...59,0...59

The command sets the time for the instrument-internal clock.

Example: `SYST:TIME 12,0,0`
'sets the time to precisely 12 pm.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:VERSion?

The command queries the SCPI version with which the instrument complies.

The command is a query command and therefore has no *RST value.

Example: `SYST:VERS?`
'queries the SCPI version.

Response: 1996
'the instrument complies with the version from 1996.

*RST value	Resolution	Options	SCPI
-	-		Compliant

TEST Subsystem

The TEST system contains the commands for performing the routines as well as for direct manipulation of the hardware assemblies (`:TEST:DIRect`). The self tests return a "0" if the test is performed successfully, otherwise a value other than "0" is returned. None of the commands of this system have an *RST value.

NOTICE **Instrument damage caused by using the following commands!**

The respective hardware assembly responds directly to the `:TEST:DIRect` command; any safety mechanisms are bypassed. The command is used for servicing purposes and should not be applied by the user. Improper use could destroy the assembly.

Command	Parameters	Default unit	Remark
TEST:DIRect	'**assembly**, subaddress, hex data string		

TEST:DIRect ‘assembly', subaddress, hex data string

The respective hardware assembly responds directly to the command; any safety mechanisms are bypassed. This function is only available via remote control.

Example:

```
TEST:DIR 'SSYN',0,#H12345678
TEST:DIR? 'SSYN',0
  Response:     '#H12345678
```

*RST value	Resolution	Options	SCPI
-	-		Device-specific

TRIGger Subsystem

The TRIGger system contains the commands for selecting the trigger source for the RF and LF sweep.

The trigger input connector is configured in the SOURce:INPut subsystem.

The trigger system of the R&S Signal Generator is a simplified implementation of the SCPI trigger system. The TRIGger system differs from the SCPI system as follows:

- No INITiate command; the instrument behaves as if `INITiate:CONTinuous ON` were set.
- Under TRIGger several sweep subsystems exist.

Other commands associated with the trigger system of the R&S Signal Generator can be found in the modulation and RF signal subsystems.

Command	Parameters	Default unit	Remark
TRIGger:LFFSweep:SOURce	AUTO|IMMediate | SINGle|BUS | EXTernal | EAUTo		
TRIGger:FSWeep[:IMMediate]			No query
TRIGger:FSWeep:SOURce	AUTO|IMMediate | SINGle|BUS | EXTernal | EAUTo		
TRIGger:PSWeep[:IMMediate]			No query
TRIGger:PSWeep:SOURce	AUTO|IMMediate | SINGle|BUS | EXTernal | EAUTo		
TRIGger[:SWEep][:IMMediate]			No query
TRIGger[:SWEep]:SOURce	AUTO|IMMediate | SINGle|BUS | EXTernal		

TRIGger:LFFSWeep:SOURce AUTO|IMMediate | SINGle|BUS | EXTernal

Both commands set the trigger source for the LF sweep (alias commands). The trigger is triggered by the command `:SOURce:LFOutput:SWEep[:FREQuency]EXECute`.

The names of the parameters correspond directly to the various settings under manual control. SCPI uses other names for the parameters; these names are also accepted by the instrument. The SCPI names should be used if compatibility is an important consideration. An overview of the various names is given in the following table:

R&S name	SCPI name	Command under manual control
AUTO	IMMediate	**Auto** mode
SINGle	BUS	**Single** mode.
EXTernal	EXTernal	**Ext Single** and **Ext Step** mode. The command LFO:SWEep:MODE is used to select between the two sweep modes.

Parameters:

AUTO | IMMediate
The trigger is free-running, i.e. the trigger condition is fulfilled continuously. As soon as one sweep is finished, the next sweep is started.

SINGle
One complete sweep cycle is triggered by the IEC/IEEE-bus commands `.:LFOutput:SWEep:EXEC` or `*TRG`. The mode has to be set to `AUTO` (`:SOURce:LFOutput:SWEep:MODE AUTO`).

EXTernal
The sweep is triggered externally via the INST TRIG connector.

EAUTo
The sweep is triggered externally via the INST TRIG connector. As soon as one sweep is finished, the next sweep is started. A second trigger event stops the sweep at the current frequency, a third trigger event starts the trigger at the start frequency, and so on.

Example:
```
TRIG:LSW:SOUR EXT
```
'selects triggering with an external trigger. The trigger is input via the INST TRIG connector.

*RST value	Resolution	Options	SCPI
SINGle	-	-	Device-specific

TRIGger:FSWeep[:IMMediate]

The command immediately starts an RF frequency sweep cycle. The command is only effective for sweep mode **Single** (`SOURce:SWEep:FREQuency:MODE AUTO` in combination with `TRIG:FSW:SOUR SING`). The command corresponds to the manual-control command **Execute Trigger**.

This command triggers an event and therefore has no *RST value.

Example:

```
SWE:FREQ:MODE AUTO
```
'sets the triggered sweep mode, i.e. a trigger is required to start the sweep.

```
TRIG:FSW:SOUR SING
```
'sets the **Single** trigger mode, i.e. a trigger starts a single sweep.

```
TRIG:FSW
```
'starts a single RF frequency sweep.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

TRIGger:FSWeep:SOURce AUTO|IMMediate | SINGle | EXTernal|BUS | EAUTo

The command sets the trigger source for the RF frequency sweep.

The names of the parameters correspond directly to the various settings under manual control. SCPI uses other names for the parameters; these names are also accepted by the instrument. The SCPI names should be used if compatibility is an important consideration. An overview of the various names is given in the following table:

R&S name	SCPI name	Command under manual control
AUTO	IMMediate	**Auto** mode
SINGle	BUS	**Single** mode.
EXTernal	EXTernal	**Ext Single** and **Ext Step** mode. The command :SWEep:FREQ:MODE is used to select between the two sweep modes.

Parameters:

AUTO | IMMediate
The trigger is free-running, i.e. the trigger condition is fulfilled continuously. As soon as one sweep is finished, the next sweep is started.

SINGle
One complete sweep cycle is triggered by the IEC/IEEE-bus commands ...:`SWEep:FREQ:EXEC` or `*TRG` or `TRIG:FSW:IMM`. The mode has to be set to `AUTO` (`SOURce:SWEep:FREQ:MODE AUTO`).

EXTernal
The sweep is triggered externally via the INST TRIG connector.

EAUTo
The sweep is triggered externally via the INST TRIG connector. As soon as one sweep is finished, the next sweep is started. A second trigger event stops the sweep at the current frequency, a third trigger event starts the trigger at the start frequency, and so on.

Example:

```
TRIG:FSW:SOUR  EXT
```
'selects triggering with an external trigger. The trigger is input via the INST TRIG connector.

*RST value	Resolution	Options	SCPI
SINGle	-		Device-specific

TRIGger:PSWeep[:IMMediate]

The command immediately starts an RF level sweep. The command is only effective for sweep mode **Single** (`SOURce:SWEep:POWer:MODE AUTO` in combination with `TRIG:PSW:SOUR SING`). The command corresponds to the manual-control command **Execute Trigger**.

This command triggers an event and therefore has no *RST value.

Example:

```
SWE:POW:MODE AUTO
```
'selects the triggered sweep mode, i.e. a trigger is required to start the sweep.

```
TRIG:PSW:SOUR AUTO
```
'sets the **Single** trigger mode, i.e. a trigger starts a single sweep.

```
TRIG:PSW
```
'starts a single RF level sweep.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

TRIGger:PSWeep:SOURce AUTO|IMMediate | SINGle | EXTernal|BUS | EAUTo

The command sets the trigger source for the RF level sweep.

The names of the parameters correspond directly to the various settings under manual control. SCPI uses other names for the parameters; these names are also accepted by the instrument. The SCPI names should be used if compatibility is an important consideration. An overview of the various names is given in the following table:

R&S name	SCPI name	Command under manual control
AUTO	IMMediate	**Auto** mode
SINGle	BUS	**Single** mode.
EXTernal	EXTernal	**Ext Single** and **Ext Step** mode. The command :SWEep:POW:MODE is used to select between the two sweep modes.

Parameters:

AUTO | IMMediate
The trigger is free-running, i.e. the trigger condition is fulfilled continuously. As soon as one sweep is finished, the next sweep is started.

SINGle
One complete sweep cycle is triggered by the IEC/IEEE-bus commands ...:`SWE:POW:EXEC` or `*TRG` or `TRIG:PSW:IMM`. The mode has to be set to `AUTO` (`SOUR:SWE:POW:MODE AUTO`).

EXTernal
The sweep is triggered externally via the INST TRIG connector.

EAUTo
The sweep is triggered externally via the INST TRIG connector. As soon as one sweep is finished, the next sweep is started. A second trigger event stops the sweep at the current level, a third trigger event starts the trigger at the start level, and so on.

Example:

```
TRIG:PSW:SOUR  EXT
```
'selects triggering with an external trigger. The trigger is input via the INST TRIG connector.

*RST value	Resolution	Options	SCPI
SINGle	-		Device-specific

TRIGger[:SWEep][:IMMediate]

The command starts the sweeps which is activated. The sweep to be executed depends on the respective MODE setting (`:SOUR:SWEep:POW|FREQ:MODE` and `:SOUR:LFO:SWEep[:FREQ]:MODE`). The command corresponds to the manual-control command **Execute Trigger**.

This command triggers an event and therefore has no *RST value.

Example: `TRIG`
'starts all active sweeps.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

TRIGger:SWEep:SOURce AUTO|IMMediate | SINGle | EXTernal|BUS

The command sets the trigger source for all sweeps.

The names of the parameters correspond directly to the various settings under manual control. SCPI uses other names for the parameters; these names are also accepted by the instrument. The SCPI names should be used if compatibility is an important consideration.

An overview of the various names is given in the following table:

R&S name	SCPI name	Command under manual control
AUTO	IMMediate	MODE AUTO
SINGle	BUS	MODE SINGLE
EXTernal	EXTernal	MODE EXT TRIG SINGLE or EXT TRIG STEP

Parameters:

AUTO | IMMediate
The trigger is free-running, i.e. the trigger condition is fulfilled continuously. As soon as one sweep is finished, the next sweep is started.

SINGle
The sweep is triggered by the IEC/IEEE-bus commands `:SOURce:SWEep:POWer|FREQuency:EXEC` or `*TRG` or `TRIGger:PSWeep|FSWeep:IMMediate`. If `:SOURce:SWEep:POWer:MODE` is set to `STEP`, one step is executed. The sweep mode has to be set to `AUTO`.

EXTernal
The sweep is triggered externally via the TRIGGER connectors.

Example: `TRIG:SWE:SOUR EXT`
'selects triggering with an external trigger. The trigger is input via the INST TRIG connector.

*RST value	Resolution	Options	SCPI
SINGle	-		Device-specific

UNIT Subsystem

The UNIT subsystem contains the commands specifying which units are valid if no unit is indicated in a command. These settings are valid for the entire instrument.

Command	Parameters	Default unit	Remark
UNIT:ANGLe	DEG | RAD		
UNIT:POWer	V | DBM		

UNIT:ANGle DEG | RAD

The command defines the default unit for angles. It is valid for all commands which determine angle values. It does not influence the manual control parameter unit and the display.

Example: `UNIT:ANGL DEG`
'sets default unit DEG for all commands which determine angle values.

*RST value	Resolution	Options	SCPI
RAD	-		Compliant

UNIT:POWer V | DBM

The command defines the default unit for power. It is valid for all commands which determine power values. It does not influence the manual control parameter unit and the display.

Example: `UNIT:POW V`
'sets default unit V for all commands which determine power values.

*RST value	Resolution	Options	SCPI
DBM	-		Compliant

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"Maintenance and Remote Control Interfaces"

8 Maintenance and Remote Control Interfaces 8.1

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8 Maintenance and Remote Control Interfaces

Introduction - Maintenance and Interfaces

The following chapter contains information on the maintenance of the signal generator and a description of the remote control interfaces.

Please follow the instructions in the service manual when exchanging modules or ordering spares. The order no. for spare parts can be found in the service manual.

The address of our support center and a list of all Rohde & Schwarz service centers can be found at the beginning of the printed manual.

The service manual includes further information particularly on troubleshooting, repair and exchange of modules.

Maintenance

The instrument does not need a periodic maintenance. What is necessary is essentially the cleaning of the instrument. However, it is recommended to check the rated data from time to time.

Cleaning the Outside and Storing

What is necessary is essentially the cleaning of the instrument.

NOTICE	**Instrument damage caused by cleaning agents!** Prior to cleaning, disconnect the product from the AC supply. Cleaning agents contain substances that may damage the instrument, e.g. solvent-containing cleaning agents may damage the front panel labeling or plastic parts. Never use cleaning agents such as solvents (e.g. diluent for lacquers, thinners, acetone, alcohol, etc), or acids, bases, or other substances. Use a soft, non-linting cloth to suitably clean the outside of the instrument.

The storage temperature range of the instrument is given in the data sheet. If the instrument is to be stored for a longer period of time, it must be protected against dust.

The original packing should be used, particularly the protective covers at the front and rear, when the instrument is to be transported or dispatched. If the original packing is no longer available, use a sturdy cardboard box of suitable size and carefully wrap the instrument to protect it against mechanical damage.

Hardware Interfaces

The following section describes the remote-control interfaces of the signal generator. All other interfaces are described in Chapter 1, sections *"Legend for Front Panel View"* and *"Legend for Rear Panel View"*. For specifications refer to the data sheet.

IEC/IEEE Bus Interface

The instrument can be equipped with an IEC/IEEE bus connector (option R&S SMC-K4, GPIB/IEEE488 Interface). The IEEE 488 interface connector is located on the rear panel. An external controller for remote control of the instrument can be connected via the IEEE 488 interface connector using a shielded cable.

Interface Characteristics

- 8-bit parallel data transfer
- bi-directional data transfer
- three-line handshake
- high data transfer rate
- up to 15 instruments can be connected
- maximal length of the interconnecting cables 15 m (single connection, 2m)
- wired-OR connection if several instruments are connected in parallel.

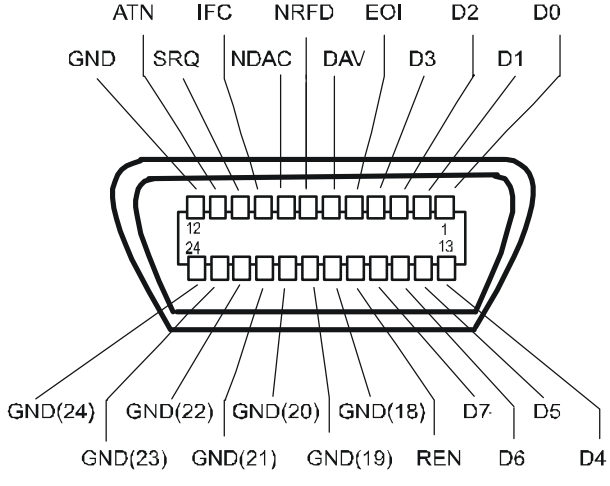


Figure 8-1 Pin assignment of IEC/IEEE-Bus interface

Bus Lines

1. Data bus with 8 lines D0 to D7.

The transmission is bit-parallel and byte-serial in the ASCII/ISO code. D0 is the least significant bit, D7 the most significant bit.

2. Control bus with 5 lines

IFC (Interface Clear)	active LOW resets the interfaces of the instruments connected to the default setting.
ATN (Attention)	active LOW signals the transmission of interface messages. inactive HIGH signals the transmission of device messages.
SRQ (Service Request)	active LOW enables the connected device to send a service request to the controller.
REN (Remote Enable)	active LOW permits switchover to remote control.
EOI (End or Identify)	has two functions in connection with ATN: ATN = HIGH active LOW marks the end of data transmission. ATN = LOW active LOW triggers a parallel poll.

3. Handshake bus with three lines

DAV (Data Valid)	active LOW signals a valid data byte on the data bus.
NRFD (Not Ready For Data)	active LOW signals that one of the connected devices is not ready for data transfer.
NDAC (Not Data Accepted)	active LOW signals that the instrument connected is accepting the data on the data bus.

IEC/IEEE-Bus Interface Functions

Instruments which can be remote controlled via the IEC/IEEE bus can be equipped with different interface functions. The following table lists the interface functions appropriate for the instrument.

Table 8-1 IEC/IEEE Bus Interface functions

Control character	Interface function
SH1	Handshake source function (source handshake), full capability
AH1	Handshake sink function (acceptor handshake), full capability
L4	Listener function, full capability, unaddress if MTA.
T6	Talker function, full capability, ability to respond to serial poll, unaddress if MLA
SR1	Service request function (Service Request), full capability
PP1	Parallel poll function, full capability
RL1	Remote/Local switch over function, full capability
DC1	Reset function (Device Clear), full capability
DT1	*Trigger function (Device Trigger), full capability*
C0	*No controller function*

IEC/IEEE Bus Messages

Interface messages are transferred on the data lines of the IEC/IEEE bus when the "ATN" control line is active (LOW). They are used for communication between controller and instruments and can only be sent by the controller which currently has control of the IEC/IEEE bus.

Universal Commands

The universal commands are encoded 10 - 1F hex. They affect all instruments connected to the bus without addressing.

Table 8-2 Universal Commands

Command	VISUAL BASIC command	Effect on the instrument
DCL (Device Clear)	IBCMD (controller%, CHR$(20))	Aborts the processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument settings..
IFC (Interface Clear)	IBSIC (controller%)	Resets the interfaces to the default setting.
LLO (Local Lockout)	IBCMD (controller%, CHR$(17))	Locks switchover from remote control to manual control by means of the front panel keys
SPE (Serial Poll Enable)	IBCMD (controller%, CHR$(24))	Ready for serial poll.
SPD (Serial Poll Disable)	IBCMD (controller%, CHR$(25))	End of serial poll.
PPU (Parallel Poll Unconfigure)	IBCMD (controller%, CHR$(21))	End of the parallel-poll state.

Addressed Commands

The addressed commands are encoded 00 - 0F hex. They are only effective for instruments addressed as listeners.

Table 8-3 Addressed Commands

Command	VISUAL BASIC Command	Effect on the instrument
SDC (Selected Device Clear)	IBCLR (device%)	Aborts the processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument setting.
GET (Group Execute Trigger)	IBTRG (device%)	Triggers a previously active device function (e.g. a sweep). The effect of the command is the same as with that of a pulse at the external trigger signal input.
GTL (Go to Local)	IBLOC (device%)	Transition to the "Local" state (manual control).
PPC (Parallel Poll Configure)	IBPPC (device%, data%)	Configures instrument for parallel poll. Additionally, the VISUAL BASIC command executes PPE/PPD.

LAN Connector

The unit is equipped with an LAN interface as standard. The LAN connector is at the rear of the instrument. Provided the appropriate rights have been assigned by the network administrator, files can be transmitted via the network, and network resources, e.g. a network folders, can be used. The instrument can also be remote-controlled and manually operated in the network. It is connected by means of a commercial RJ45 cable.

The network card functions with 100 MHz Ethernet IEEE 802.3u. The TCP/IP network protocol and the associated network services are preconfigured. TCP/IP ensures connection-oriented communication, where the order of the exchanged messages is adhered to and interrupted links are identified. With this protocol, messages cannot be lost.

Connection of the Vector Signal Generator is described in Chapter 1, section "*Connection to the Network*", remote control via Ethernet in chapter 5, section "*Remote control via Ethernet* ". The architecture of a LAN remote-control connection is described in detail in the following.

Remote control of an instrument via a network is based on standardized protocols which follow the OSI reference model (see Fig. below).

Application	SCPI	SCPI [3]
Presentation	XDR (VXI-11)	RFC 1014 [1,2]
Session	ONC-RPC	RFC 1057
Transport	TCP / UDP	RFC 793
Network	IP	RFC 791
Data Link	Ethernet/802.3	8802-3
Physical	802.3/10BASE-T	8802-3

Figure 8-2 Example for LAN remote control based on the OSI reference model

Based on TCP/UDP, messages between the controller and the instrument are exchanged via open network computing (ONC) - remote procedure calls (RPC). With XDR, legal RPC messages are known as VXI-11 standard. Based on this standard, messages are exchanged between the controller and the instrument. The messages are identical with SCPI commands. They can be organized in four groups: program messages (control command to the instrument), response messages (values returned by the instrument), service request (spontaneous queries of the instrument) and low-level control messages (interface messages).

A VXI-11 link between a controller and an instrument uses three channels: a core, abort and interrupt channel. Instrument control is mainly performed on the core channel (program, response and low-level control messages). The abort channel is used for immediate abort of the core channel; the interrupt channel transmits spontaneous service requests of the instrument. Link setup itself is very complex. For more details refer to the VXI-11 specification ("TCP/IP Instrument Protocol Specification VXI-11, Revision 1.0 VMEbus Extensions for Instrumentation, VXIbus", and "TCP/IP-IEEE 488.2 Instrument Interface Specification VXI-11.3, Draft 0.3 VMEbus Extensions for Instrumentation, VXIbus").

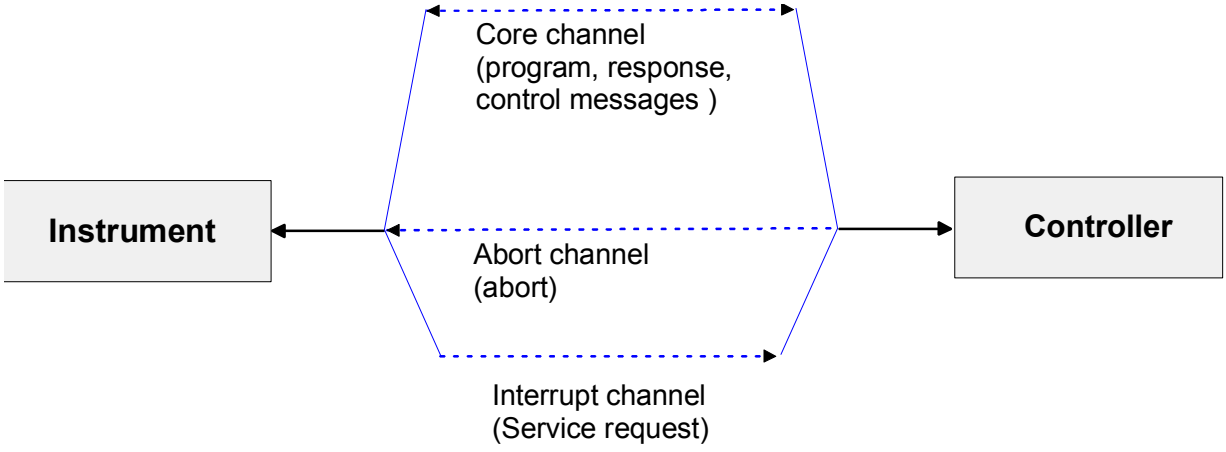


Figure 8-3 VXI-11 channels between instrument and controller

The number of controllers that can address an instrument is practically unlimited in the network. In the instrument, the individual controllers are clearly distinguished. This distinction continues up to the application level in the controller, i.e. two applications on a PC are identified by the instrument as two different controllers.

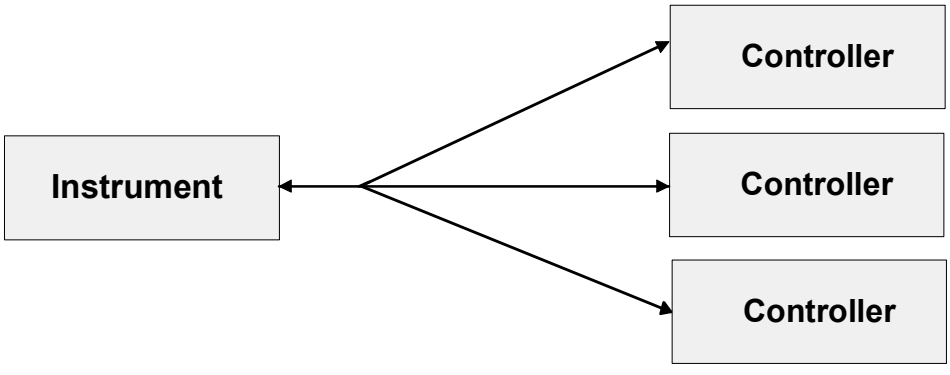
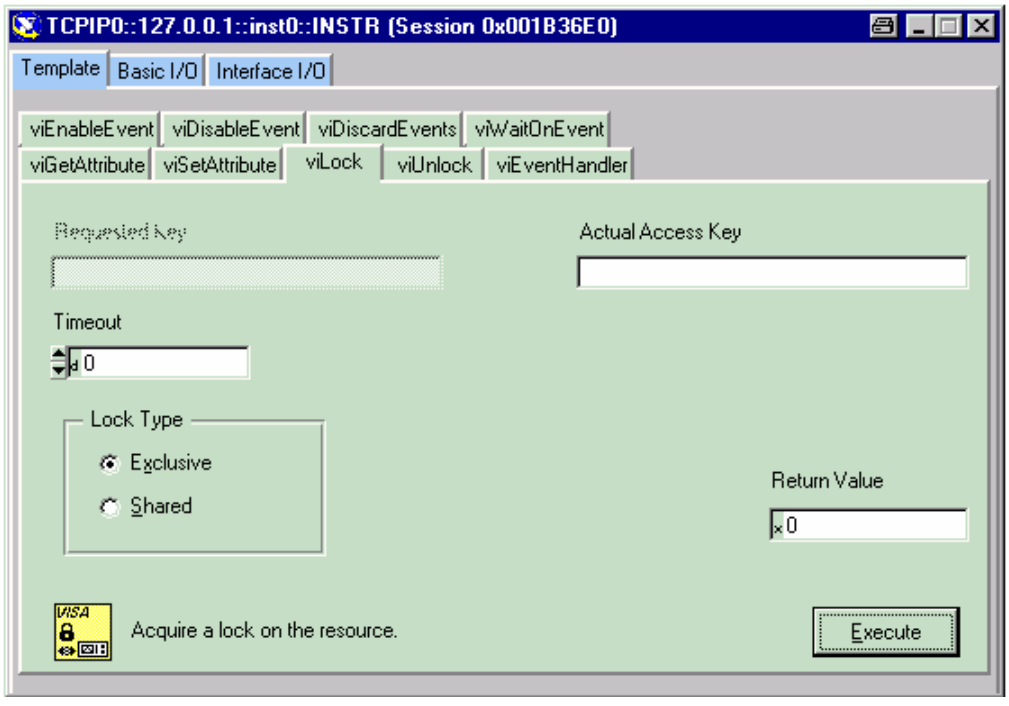


Figure 8-4 Remote control via LAN from several controllers

The controllers can lock and unlock the instrument for exclusive access. This regulates access to the instrument of several controllers.

In the **'Measurement & Automation Control'** program, this setting is made on the **Template** tab.



VXI-11 Interface Messages

On the Ethernet link, the interface messages are called low-level control messages. These messages can be used to emulate interface messages of the IEC/IEEE bus.

Table 8-4 VXI-11 Interface Messages

Command		Effect on the instrument
&ABO	(Abort)	Aborts the processing of the commands just received.
&DCL	(Device Clear)	Aborts the processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument setting.
&GTL	(Go to Local)	Transition to the "Local" state (manual control)
&GTR	(Go to Remote)	Transition to the "Remote" state (remote control)
&GET	(Group Execute Trigger)	Triggers a previously active device function (e.g. a sweep). The effect of the command is the same as with that of a pulse at the external trigger signal input.
&LLO	(Local Lockout)	Disables switchover from remote control to manual control by means of the front panel keys
&POL	(Serial Poll)	Starts a serial poll
&NREN	(Not Remote Enable)	Enables switchover from remote control to manual control by means of the front panel keys

USB Connection (USB and USB IN)

The instrument is equipped as standard with three USB (universal serial bus) interfaces which are located at the rear of the instrument.

USB

One of them is a type A interfaces (host USB) which establishes a connection to the controller. It can be used for connecting peripherals such as mouse and keyboard or a memory stick for data transmission.

USB IN

The second USB interface is a type B interface (device USB) hence the instrument is assigned as device, not as host. It can be used for remote control (see chapter "*Remote Control - Basics*").

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9 Error Messages

Introduction - Status Information and Messages

This chapter describes the error messages of the signal generator. The error messages are output in the **Info** line on the screen and entered in the error error/event queue of the status reporting system.

A great variety of different messages such as status messages, error messages, warnings or information are displayed in the header field of the screen. Some error messages require that the error must be eliminated before correct instrument operation can be ensured. The info window with a list of current messages and a detailed description of each message can be opened with the INFO key

In the remote control mode, error messages are entered in the error/event queue of the status reporting system and can be queried with the command `SYSTem:ERRor?`. If the error queue is empty, 0 ("No error") is returned.

Status Information

The status messages are displayed in the header section of the screen. The status information gives the user an overview of the main operating states and settings of the signal generator. The states are indicated for information only and do not necessitate any action by the user. Status information is displayed between the frequency and level fields, at the left of the info line or in the info line itself.

Status information displayed between the frequency and level fields:

RF OFF The RF output is switched off

MOD OFF All modulations are switched off.

FREQ OFFSET A frequency offset is set.

The frequency entered and displayed in the frequency field takes any set frequency offset into consideration, e.g. an offset set for a downstream instrument. This means that with a frequency offset the frequency displayed in the header does not correspond to the frequency at the RF output, but rather to the frequency at the output of the downstream instrument.

This allows the desired frequency at the output of a downstream instrument to be entered in the frequency field. The signal generator changes the RF output frequency according to the entered offset.

However, the frequency entered and displayed in the Frequency/Phase menu of the RF/Ana Mod function block always corresponds to the RF output frequency. Any frequency offset is not taken into consideration.

The correlation is as follows:

Freq in header = RF output frequency (= Freq in menu) + Freq offset (= Offset in menu)

LEVEL OFFSET A level offset is set.

The level entered and displayed in the Level field takes the offset of any downstream attenuators/amplifiers into consideration by way of calculation. This means that with a level offset the level displayed in the header does not correspond to the level at the RF output, but rather to the level at the output of the downstream instrument.

This allows the desired level at the output of downstream instruments to be entered. The signal generator changes the RF output level according to the set offset.

However, the level entered and displayed in the **Level** menu of the **RF/Ana Mod** function block always corresponds to the RF output level. Any level offset is not taken into consideration.

The correlation is as follows:

Level in header = RF output level (= Level in menu) + Level offset

EXT REF An external reference is used.

The external signal with selectable frequency and defined level must be input at the REF IN connector. It is output at the REF OUT connector.

Status information displayed to the left of the Info line:

REMOTE The instrument is remote controlled.

The LOCAL key switches the instrument from remote control to manual control. The current command must be fully processed before the mode is switched, otherwise the instrument switches immediately back to remote control.

REM LLO The instrument is remote controlled.

The instrument can be switched from remote control to manual control by means of remote control only (e.g. with the Visual Basic command `CALL IBLOC (generator%)`); the LOCAL key is disabled. The key is disabled by remote control with the command LLO.

Status information displayed in the Info line:

RFSweep
LevelSweep
LFSweep The indicated sweep is enabled.

ALC On/Auto/S&H The status of the automatic level control is indicated:

- ON = automatic level control permanently on
- Auto = automatic level control is automatically adapted to the operating states
- S&H = automatic level control off, recalibration of the level whenever the level or frequency is set (sample and hold mode).

AttFixed Attenuator fixed mode is active.

The uninterrupted level settings are made in a fixed range without attenuator switching. The variation range is set automatically when this mode is activated. The range is displayed under **Attenuator Fixed Range** in the **Level** menu.

UCorr User Correction is active.

The level is corrected by the given values in the selected user correction list. Correction is performed by the user-defined list values being added to the output level for the respective RF frequency. With frequencies which are not contained in the list, the level correction is determined by interpolation of the closest correction values.

OvenCold The reference oscillator has not yet reached its nominal frequency.

When switching on from the STANDBY mode, the specified frequency accuracy is reached immediately. If the power switch was switched off, the reference oscillator needs some warm-up time to reach its nominal frequency. During this period of time, the output frequency does not yet reach its final value either.

Error Messages

Messages indicate errors in the instrument. They are displayed in the info line in different colors depending on their importance and display duration. Errors (e.g. no calibration data) are displayed in red, information (e.g. file not found) and warnings in black. Warnings indicate less significant errors (e.g. the instrument operates outside specified data).

Volatile messages

Volatile messages report automatic settings in the instrument (e.g. switching off of incompatible types of modulation) or on illegal entries that are not accepted by the instrument (e.g. range violations). They are displayed in the info line on a yellow background. They are displayed on top of status information or permanent messages.

Volatile messages do not normally demand user actions and disappear automatically after a brief period of time. They are stored in the history, however.

Remote-control command:
`SYST:ERR? or SYST:ERR:ALL?`

Permanent messages

Permanent messages are displayed if an error occurs that impairs further instrument operation, e.g. a hardware fault. The error signaled by a permanent message must be eliminated before correct instrument operation can be ensured.

The message is displayed until the error is eliminated. It covers the status display in the info line. After error elimination, the message automatically disappears and is also recorded in the history.

Remote-control command:
`SYST:SERR?`

Alphabetical List of SCPI-Error Messages

The following list contains all error messages defined in SCPI in alphabetical order. SCPI error messages are the same in all SCPI instruments. The errors are assigned negative numbers.

The error text being entered into the error/event queue or being displayed is printed in bold face on the left together with the error code. Below the error text, there is an explanation as to the respective error.

Note:
The index provides a list of the error messages sorted according to their error codes.

Block data not allowed (-168)

The command contains legal block data which are not allowed at this point.

Example: The command `SOUR:FREQ` requires a numeric parameter - `FREQ #13a`

SCPI: Command error - sets bit 5 in the ESR register

Character data not allowed (-148)

The character data is prohibited for this command or at this point of the command.

Example: Command `SOURce:FREQuency` requires a numeric parameter.

SCPI: Command error - sets bit 5 in the ESR register

Character data too long (-144)

The character data element contains more than 12 characters.

SCPI: Command error - sets bit 5 in the ESR register

Command Error (-100)

Generic error message that cannot detect a more specific error.

SCPI: Command error - sets bit 5 in the ESR register

Command protected (-203)

The desired command could not be executed as it was protected with a password.

Example: The command `CAL:FREQ?` might be protected with a password.

Remedy Use command `:SYST:PROT1 OFF, 123456` to enable the command.

SCPI: Execution error - sets bit 4 in the ESR register

Data out of range (-222)

A value of the transmitted command was outside the legal range.

Example: Command `SOUR:FREQ` only permits entries in the range of min to max frequency.

SCPI: Execution error - sets bit 4 in the ESR register

Data type error (-104)

The command contains an invalid value indication.

Example: ON is indicated instead of a numeric value for frequency setting - `:FREQ ON`

SCPI: Command error - sets bit 5 in the ESR register

Device-specific error (-300)

Device-specific error not defined in greater detail.

SCPI: Device-specific error - sets bit 3 in the ESR register

Exponent too large (-123)

The magnitude of the exponent is too large.

SCPI: Command error - sets bit 5 in the ESR register

Expression data not allowed (-178)

The command contains a mathematical expression at an impermissible position.

SCPI: Command error - sets bit 5 in the ESR register

GET not allowed (-105)

A Group Execute Trigger (GET) is within a command line.

Note: A Group Execute Trigger (`GET`) is only allowed at the end of a command line or in a separate command line.

SCPI: Command error - sets bit 5 in the ESR register

Hardware error (-240)

A legal program command or a query could not be executed because of a hardware problem in the device.

SCPI: Execution error - sets bit 4 in the ESR register

Hardware missing (-241)

A legal program command or a query could not be executed because of a missing device hardware.

Example: An option is not fitted.

SCPI: Execution error - sets bit 4 in the ESR register

Header suffix out of range (-114)

The command contains an illegal numeric suffix.

Example: `:SOURce22` is not defined for the signal generator.

SCPI: Command error - sets bit 5 in the ESR register

Illegal parameter value (-224)

The parameter value is invalid.

Example: An invalid text parameter is indicated :
`TRIG:SWEep:SOUR TASTe`

SCPI: Execution error - sets bit 4 in the ESR register

Invalid block data (-161)

The command contains illegal block data.

Example: An END message was received before the expected number of data had been received or no numeric data element is sent after the introductory #

SCPI: Command error - sets bit 5 in the ESR register

Invalid Character (-101)

The command contains an invalid sign.

Example: A header contains an ampersand, "`SOURCE&`".

SCPI: Command error - sets bit 5 in the ESR register

Invalid separator (-103)

The command contains an impermissible sign instead of a separator.

Example: A semicolon is missing after the first command in a command line with several commands -
"`:FREQ 2MHz POW -25`".

SCPI: Command error - sets bit 5 in the ESR register

Invalid suffix (-131)

The suffix is not appropriate for this command.

Example: nHz is not defined.

SCPI: Command error - sets bit 5 in the ESR register

Lists not same length (-226)

The parts of a list have different lengths. This error message is also displayed if only part of a list has been transmitted via IEC bus. All parts of the list have to be transmitted always before it is executed.

Example: The POWer list content is longer than the FREQuency list content, or only the POWer content is transmitted.

SCPI: Execution error - sets bit 4 in the ESR register

Missing parameter (-109)

The command does not contain the required parameters.

Example: Command `:SOUR:FREQ` requires the indication of a parameter - `":FREQ; POW -35"`

SCPI: Command error - sets bit 5 in the ESR register

No error (0)

This message is output if the error queue does not contain entries.

Numeric data not allowed (-128)

The command contains a numeric data element the device does not accept in this position.

Example: The command `:SOUR:BB:MCCW:SEQ` requires the indication of a text parameter - `SOUR:BB:MCCW:SEQ AUTO`.

SCPI: Command error - sets bit 5 in the ESR register

Out of memory (-225)

The storage space available in the instrument is exhausted.

SCPI: Execution error - sets bit 4 in the ESR register

Parameter not allowed (-108)

The command contains too many parameters.

Example: Command `SOURce:FM:INTernal:FREQuency` permits only one frequency indication - `":FREQ:CENT 30 kHz, 40 kHz"`.

SCPI: Command error - sets bit 5 in the ESR register

Program mnemonic too long (-112)

The header contains more than 12 characters.

SCPI: Command error - sets bit 5 in the ESR register

Queue overflow (-350)

This error code is entered into the queue instead of the actual error code if the queue is full. It indicates that an error has occurred but not been recorded in the queue. The original error message is lost.

Remedy: Reading out the error messages e.g. with command `SYSTem:ERRor:ALL?` clears the error queue.

SCPI: Device specific error- sets bit 3 in the ESR register

Query interrupted (-410)

This query has been interrupted.

Example After a query, the instrument receives new data before the response has been sent completely.

SCPI: Query error - error in data request - sets bit 2 in the ESR register.

Query unterminated (-420)

This query is missing or incomplete.

Example The instrument is addressed as a talker and receives incomplete data.

SCPI: Query error - error in data request - sets bit 2 in the ESR register.

Query deadlocked (-430)

This query cannot be processed.

Example The input and output buffers are full, the instrument cannot be operated.

SCPI: Query error - error in data request - sets bit 2 in the ESR register.

Self test failed ... (-330)

An error was detected in the selftest named after the semicolon. An error-free operation of the module concerned is no longer guaranteed.

SCPI: Device specific error- sets bit 3 in the ESR register

Settings conflict ... (-221)

There is a setting conflict between the two parameters indicated after the semicolon.

Example: The set FM deviation is too large for the selected RF frequency.

Remedy One of the given values has to be corrected to obtain a valid output signal.

SCPI: Execution error - sets bit 4 in the ESR register

String data not allowed (-158)

The command contains a legal string data element which is not allowed at this point.

Example: A text parameter is set in quotation marks - `SOURce:FREQuency:MODE "FIXed".`

SCPI: Command error - sets bit 5 in the ESR register

Suffix not allowed (-138)

A suffix is not allowed for this command or at this point of the command.

Example: Command *RCL does not permit indicating a suffix.

SCPI: Command error - sets bit 5 in the ESR register

Suffix too long (-134)

The suffix contains more than 12 characters.

SCPI: Command error - sets bit 5 in the ESR register

Syntax error (-102)

The command is invalid.

Example: The command contains block data the instrument does not accept.

SCPI: Command error - sets bit 5 in the ESR register

System error (-310)

This error message suggests an error within the instrument. Please inform the R&S Service.

SCPI: Device specific error- sets bit 3 in the ESR register

Too many digits (-124)

The decimal numeric data element contains too many digits.

SCPI: Command error - sets bit 5 in the ESR register

Too much data (-223)

More data were sent by the host than the signal generator can handle.

SCPI: Execution error - sets bit 4 in the ESR register

Undefined header (-113)

The sent command header has not been defined.

Example: Header `:*XYZ` is undefined for every instrument.

SCPI: Command error - sets bit 5 in the ESR register

Alphabetical List of Device-Specific Error Messages

The following list contains all error messages specific of the instrument in alphabetical order. The positive error codes mark the errors specific of the instrument.

The error text being entered into the error/event queue or being displayed is printed in bold face on the left together with the error code. Below the error text, there is an explanation as to the respective error.

Note:
The index provides a list of the error messages sorted according to their error codes.

Extern reference out of range or disconnected (50)

External reference is selected but no external signal is applied or the signal is out of range.

Remedy: Check the selected reference signal source (internal or external) in the Reference Oscillator menu (Setup). Change setting to 'internal' if no approriate external source is available.

SCPI: Device-specific error - sets bit 3 in the ESR register

Adjustment data invalid (183)

Adjustment data are invalid and must be restored.

Remedy: The adjustment data have to be generated again by an internal or external adjustment or to be loaded into the instrument.

SCPI: Device-specific error - sets bit 3 in the ESR register

Adjustment data missing (182)

Adjustment data are missing.

Remedy: The adjustment data have to be generated first by an internal or external adjustment or to be loaded into the instrument.

SCPI: Device-specific error - sets bit 3 in the ESR register

Adjustment failed (180)

Adjustment could not be executed

Remedy: The adjustment data have to be generated first by an internal or external adjustment or to be loaded into the device (see section Adjustment).

SCPI: Device-specific error - sets bit 3 in the ESR register

Cannot access the EEPROM (202)

A error occurs when writing or reading a EEPROM.

Example: The EEPROM is defect.

SCPI: Device-specific error - sets bit 3 in the ESR register

Cannot access hardware (200)

The data transmission to a module was unsuccessful.

Example: The module is not installed, not properly installed or missing.

SCPI: Device-specific error - sets bit 3 in the ESR register

Cannot open file (460)

The selected file can not be opened.

Remedy: Check the path and file name.

SCPI: Device-specific error - sets bit 3 in the ESR register

Cannot read file (462)

The file can not be read.

Example: The file contents are not compatible with the file type.

SCPI: Device-specific error - sets bit 3 in the ESR register

Cannot write file (461)

The file can not be written.

Example: The file is read-only.

SCPI: Device-specific error - sets bit 3 in the ESR register

Driver initialization failed (204)

Initialization of a driver fails when booting the instrument firmware

Example: The driver is not compatible with the hardware or software configuration of the instrument.

SCPI: Device-specific error - sets bit 3 in the ESR register

File contains invalid data (465)

The selected file contains data that is not valid for the file type. The file extension determines the data that is valid for this file type. If the file extension is changed the lists are no longer recognized and the data are therefore invalid.

Example: The extension of a waveform file (= *.wv) was changed to *.txt.

SCPI: Device-specific error - sets bit 3 in the ESR register

Filename missing (463)

The desired operation cannot be execute because the file name is not specified.

Example: A file name has to be entered when creating a new list.

SCPI: Device-specific error - sets bit 3 in the ESR register

Hardware revision out of date (201)

A later version of certain parts of the instrument is necessary to execute the function selected.

Example: The driver does not support the installed version of a module.

SCPI: Device-specific error - sets bit 3 in the ESR register

Invalid EEPROM data (203)

Reading a EEPROM is possible, however the data are inconsistent.

SCPI: Device-specific error - sets bit 3 in the ESR register

Invalid filename extension (464)

The file extension is not valid for the desired operation.

Example: The file extension for user correction files is ***.uco**. It is not possible to enter another file extension when storing a user correction file.

SCPI: Device-specific error - sets bit 3 in the ESR register

No current list (241)

There is no list selected. To execute the desired operation a list has to be selected in the related menu. If no list is available, a new list must be created.

Example: The user correction mode is enable without a list being selected.

SCPI: Device-specific error - sets bit 3 in the ESR register

This modulation forces other modulations off (140)

A modulation has been switched on which cannot be used at the same time as an already active modulation. The previous modulation has been switched off.

Example: Enabling FM modulation switches PM modulation off.

SCPI: Device-specific error - sets bit 3 in the ESR register

Unknown list type specified (242)

The list type selected is not valid for the desired operation

Example: The file extension for user correction files is ***.uco**. It is not possible to enter another file extension when selecting a user correction file.

SCPI: Device-specific error - sets bit 3 in the ESR register

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Test Equipment Depot - 800.517.8431 - 99 Washington Street Melrose, MA 02176

FAX 781.665.0780 - TestEquipmentDepot.com

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